ACRONYMS AND ABBREVIATIONS	
ACI	American Concrete Institute
AMA	Aging Management Activity
AMP	Aging Management Program
AMR	Aging Management Review
ANSI	American National Standards Institute
ASM	American Society for Metals
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
BEA	Battelle Energy Alliance
CC	Criticality Control
CLB	Current Licensing Basis
CLUP	Cask Load/Unload Port
CFS	Charge Face Structure
CHM	Container Handling Machine
CWI	CH2M-WG Idaho, LLC
DCSS	Dry Cask Storage System
DOE	U. S. Department of Energy
DOE-ID	U. S. Department of Energy Idaho Operations Office
DUP	Depleted Uranium Shield Plug
EDF	Engineering Design File
EM	DOE Office of Environmental Management
EFPD	Effective Full Power Days
EPRI	Electric Power Research Institute
FSC	Fuel Storage Container
FSV	Fort St. Vrain
FWEA	Foster Wheeler Energy Applications
FWENC	Foster Wheeler Environmental Corporation
GEC	General Electric Company
GTCC	Greater Than Class C
HT	Heat Transfer
HTGR	High Temperature Gas Cooled Reactor
ICP	Idaho Cleanup Project
INL	Idaho National Laboratory
ISFSI	Independent Spent Fuel Storage Installation
LLW	Low-Level Waste
LRA	License Renewal Application
MVDS	Modular Vault Dry Store
NCR	Non-Conformance Report
NE	DOE Office of Nuclear Energy
NRC	U. S. Nuclear Regulatory Commission
PB	Pressure Boundary
PSCo	Public Service Company of Colorado
PURAM	Public Agency for Radioactive Waste Management

QA	Quality Assurance
RS	Radiation Shielding
SAR	Safety Analysis Report
SER	Safety Evaluation Report
SI	Structural Integrity
SS	Support Stool
SSC	System, Structure and Component
SSW	Standby Storage Well
SPHD	Shield Plug Handling Device
TCRB	Transfer Cask Reception Bay
TLAA	Time Limited Aging Analysis
USPHD	Uranium Shield Plug Handling Device
W	Watt

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LIST OF TABLES:

1.0 GENERAL INFORMATION

The United States Department of Energy (DOE) has prepared this application for renewal of the site-specific license for the Fort St. Vrain (FSV) Independent Spent Fuel Storage Installation (ISFSI) located in Platteville, CO. This application supports license renewal for an additional 20 year period beyond the end of the current license term of Materials License Number SNM-2504 (Docket No. 72-9). The original 20 year license will expire on November 30, 2011. This application includes the general, technical, and environmental supporting information required by applicable portions of Subpart B of 10 CFR Part 72 for applications for license renewal pursuant to 10 CFR 72.42(b).

The information contained in this section includes:

- Information on the organization of the application (Section 1.1).
- A general description of the FSV ISFSI facility (Section 1.2).
- The administrative information required by 10 CFR 72.22 (Section 1.3).
- Summary of abbreviations and intended function code definitions (Section 1.4).
- A list of the references for Section 1.0, General Information (Section 1.5).

1.1 APPLICATION FORMAT AND CONTENT

The format and content of the application are based on 10 CFR Part 72 (Reference 1.5-1), the U. S. Nuclear Regulatory Commission (NRC) "Preliminary Guidance for License Renewal for Site-Specific Independent Spent Fuel Storage Installations (ISFSI)" (Reference 1.5-2) and Virginia Electric Power Company comments on the NRC's preliminary guidance (Reference 1.5-3); the precedent of the H. B. Robinson Steam Electric Plant, Unit 2, Site-Specific ISFSI license renewal application (Reference 1.5-4); the precedent of the Oconee Nuclear Station ISFSI license renewal application (Reference 1.5-5), and NUREG-1567, Standard Review Plan for Spent Fuel Dry Storage Facilities (Reference 1.5-8), and include:

- General Information – Section 1.0 has been expanded beyond the general administrative requirements of 10 CFR 72.22 to provide (1) information on the format and content of the application, (2) general facility description, and (3) a summary of abbreviations and intended function code definitions used in the application.
- Scoping Evaluation – Section 2.0 provides the scoping evaluation for the ISFSI systems, structures, and components (SSCs).
- Aging Management Reviews – Section 3.0 includes the methodology and results

of the aging management reviews (AMRs) performed for ISFSI SSCs that are in the scope of license renewal.

- Appendices:

  Appendix A: Aging Management Program (AMP)

  Appendix B: Time-Limited Aging Analyses (TLAAs)

  Appendix C: Safety Analysis Report (SAR) Supplement and Changes

  Appendix D: Technical Specifications Changes

  Appendix E: Environmental Report Supplement

  Appendix F: Additional information (training and qualifications, financial assurance for decommissioning and emergency planning)

  Appendix G: Decommissioning Plan Supplement

1.2 FACILITY DESCRIPTION

The High Temperature Gas Cooled Reactor (HTGR) at Fort St. Vrain, which was built and operated as an advanced reactor concept with cooperation between the U. S. Atomic Energy Commission, Gulf General Atomic, and Public Service Company of Colorado (PSCo), was permanently shut down in August 1989. PSCo removed the fuel and other radioactive reactor components from the reactor vessel. For safe, onsite dry storage of the spent reactor fuel and irradiated core components, PSCo designed and built the FSV ISFSI. The ISFSI was designed for storage of up to 1,482 fuel elements which are known as standard fuel elements, control fuel elements, and bottom control fuel elements; 1,458 elements of which are stored in the facility. Since there are six spent fuel elements stored in a fuel storage container (FSC), there are 243 FSCs storing standard, control, or bottom control spent fuel elements at the FSV ISFSI.

The ISFSI also was designed for storage of up to 37 keyed top reflector control rod elements. The reflector elements were planned to be stored as “other radioactive material associated with spent fuel storage” as defined in the 10 CFR 72.4 definition of spent nuclear fuel. PSCo originally had planned to store the 37 keyed top reflector control rod elements in the ISFSI, since it was considered likely that these elements would fall under the Greater than Class C (GTCC) waste designation. The GTCC waste designation would have precluded their shipment to a low-level waste (LLW) disposal facility. However, it was determined that these 37 keyed top reflector control rod elements were not GTCC waste, so they were removed by PSCo to a LLW disposal facility, and are not stored at the ISFSI.

In addition, the ISFSI was designed to safely store six neutron source fuel elements containing Californium-252 (Cf-252) neutron sources. Each of these six neutron source fuel elements originally contained an encapsulated source near the center of the element. Planning for storage of these neutron source fuel elements at the ISFSI required the design and construction of a special storage well to adequately shield the neutron flux from these elements. However, the neutron sources were removed from these elements and sold by PSCo prior to the transfer of the elements to the ISFSI. Therefore, although there are six neutron source fuel elements in storage at the ISFSI, these elements do not contain the Cf-252 sources. The six fuel elements that formerly contained the neutron sources are not included in the 1,458 spent fuel elements discussed above and bring the total to 1,464 elements in 244 FSCs stored at the FSV ISFSI.

Design and analysis of the ISFSI for storage of the 37 keyed top reflector control rod elements was completed before PSCo determined that the top reflector elements and the neutron sources could be removed from the site and not stored in the ISFSI. Therefore, the provisions for their storage were an integral part of the initial safety analysis of the ISFSI.

The FSV ISFSI uses the Modular Vault Dry Store (MVDS) system. The MVDS system is designed to safely hold all types of irradiated fuel for intermediate storage periods. A design for light water reactor fuels was submitted to the NRC for licensing approval in the Energy Applications Division of Foster Wheeler Energy Corporation [formerly Foster Wheeler Energy Applications, Inc. (FWEA)] Topical Safety Analysis Report (Reference 1.5-6). The NRC approved the MVDS design in March 1988 with publication of a Safety Evaluation Report (SER) noting that alternate fuel designs were acceptable if they could be demonstrated to be less restrictive than the light water reactor design basis irradiated fuel assemblies in the vault module design (Reference 1.5-7). On February 1, 1991 PSCo received an Environmental Assessment from the NRC with a Notice of Issuance and Finding of No Significant Impact associated with constructing and operating the FSV ISFSI. On November 4, 1991 PSCo received a twenty year, renewable, NRC License pursuant to 10 CFR 72 (Materials License No. SNM-2504) to receive, possess, store, and transfer FSV spent fuel in the ISFSI.

PSCo began loading the ISFSI with FSV spent fuel on December 26, 1991. Loading of FSV spent fuel into the ISFSI was completed on June 10, 1992. In December of 1995, the DOE notified the NRC of its intent to procure the ISFSI from PSCo, to take possession of the fuel stored in it, and to transfer the license to DOE. An Agreement in Principle was incorporated by a contract modification between DOE and PSCo (Contract No. DED-AC07-96-ID134265) on February 9, 1996. With this agreement, DOE immediately took possession of the FSV fuel stored in the ISFSI. PSCo continued to manage the spent fuel in accordance with the license SNM-2504 until June 4, 1999 when the license was transferred to DOE (Reference 1.5-9).

The FSV MVDS is designed for interim storage of Fort St. Vrain HTGR fuel for 40 years in a contained shielded system. The design provides for up to six fuel elements or up to 12 reflector elements stacked vertically in each FSC. There is a matrix of 45 fuel storage positions within each of six concrete vault modules (for a total of 270 storage positions with one FSC per storage position), which provides shielding and the conditions to prevent criticality. The six vault modules are designed to accommodate the complete FSV core consisting of six segments. Because three shipments of the first FSV core loading were shipped to the Idaho National Laboratory (INL), only 244 of the available storage positions contain fuel elements. Each position contains six fuel elements making a total of 1,464 elements stored at the FSV ISFSI. The fuel storage medium within the FSC is air, and the decay heat is removed by a once-through buoyancy driven ambient air system flowing across the exterior of the FSCs. Three storage wells embedded in concrete are provided separate from the six vault modules. One of these wells was designed to provide storage for the six neutron source elements although no Cf-252 neutron source elements are stored there. Although no FSC has developed a leak, each of these three wells provide a means to store and confine an FSC in the event one should develop a leak. All three wells are identical in construction and can be individually sealed. Although not currently allowed in the license, these wells provide a means to transfer fuel elements from a leaking FSC to a new FSC. These three storage wells are functionally stand-by storage wells (SSWs). The ambient air system does not flow across the exterior of the FSCs stored in the SSWs.

The fuel, in its FSC, was transported by PSCo to the MVDS from the FSV Reactor Building in a transfer cask. The transfer cask was received in the transfer cask reception bay (TCRB) where it was removed from the transfer cask trailer by the MVDS crane and positioned in the cask load/unload port (CLUP) for unloading. The transfer cask was prepared for unloading by removing the outer closure of the transfer cask and positioning an isolation valve above the transfer cask. A depleted uranium shield plug (DUP) was removed from the top of the FSC using a uranium shield plug handling device (USPHD). A shield plug handling device (SPHD) was used to remove the charge face shield plug in conjunction with the isolation valve at the FSC storage position in the vault module. A shielded container handling machine (CHM), carried by the MVDS crane, removed the FSC from the transfer cask and placed it in the vault module storage matrix in conjunction with an isolation valve. An empty FSC was then loaded into the transfer cask and returned to the FSV Reactor Building where it was loaded with fuel and returned to the MVDS. This cycle was repeated using three transfer casks until all spent fuel was loaded into the MVDS by PSCo.

1.3 INFORMATION REQUIRED BY 10 CFR 72.22

1.3.1 NAME AND ADDRESS OF APPLICANT

Department of Energy
Idaho Operations Office
1955 Fremont Avenue
Idaho Falls, ID 83415

1.3.2 ADDRESS OF THE FSV ISFSI

FSV ISFSI
17122 Weld County Road 19 ½
Platteville, CO 80651

1.3.3 DESCRIPTION OF BUSINESS OR OCCUPATION OF APPLICANT

The Department of Energy is a cabinet level department of the Federal Government authorized by the Atomic Energy Act of 1954, as amended, the Energy Reorganization Act of 1974 (42 U.S.C. 5801), and the Department of Energy Organization Act (42 U.S.C. 7101). The DOE organization responsible for activities authorized by Materials License SNM-2504 is the DOE Idaho Operations Office (DOE-ID). The Secretary of Energy, by Delegation Order No. 10CFR72.512.1, signed October 31, 1996, delegated authority to the Manager, DOE-ID to perform on the Secretary's behalf as applicant and named holder for the NRC license for the Fort St. Vrain ISFSI under NRC regulatory authority.

DOE-ID directs the activities of the INL, which consists of two separate and discrete missions that are supported by separate and distinct contractors. DOE-ID's mission is to provide the vision, leadership, and management to effectively execute technology programs while promoting regional economic growth, industrial and government partnerships, and safe, environmentally sound operations. The INL has primary missions of nuclear reactor research and development; environmental restoration, including waste management remediation, cleanup, and technology development; spent nuclear fuel management; nuclear process operations; and a broad suite of technological research and development programs. As part of its mission, DOE has maintained safe and compliant operations of both the FSV and Three Mile Island, Unit 2 (TMI-2) ISFSIs (Materials Licenses SNM-2504 and SNM-2508) as licensee since 1999.

DOE-ID operates the INL with approximately 5,900 federal and contractor employees, not including the Advanced Mixed Waste Treatment Project located at the Radioactive Waste Management Complex and the Naval Reactors Facility also on the INL. Of this total, approximately 290 are DOE-ID federal employees, 1,461 are CH2M-WG Idaho, LLC (CWI) employees, and 3,983 are Battelle Energy Alliance (BEA) employees.

The base INL mission is that of a lead laboratory for nuclear energy development and demonstration under DOE's Office of Nuclear Energy (NE). BEA, the laboratory contractor as of February 1, 2005, is contracted to support DOE-ID in accomplishing this mission objective. As it relates to safe and compliant management of the ISFSIs under DOE's Office of Environmental Management (EM), BEA also administers and provides key site services including on-site physical protection and emergency response (not including the FSV ISFSI, which is under separate local agreements in Colorado), as well as operating the DOE-ID Warning Communications Center (which also monitors the FSV ISFSI as well).

The complementary mission of DOE-ID is cleanup of the INL under DOE EM. This mission is known as the Idaho Cleanup Project (ICP). CWI, a consortium comprised largely of CH2M-Hill and Washington Group International, is the contractor for the ICP. Management of the FSV ISFSI under DOE-ID supervision and responsibility resides with this ICP contractor. In addition to staffing and operating the ISFSI, the ICP contractor obtains services from the INL contractor (BEA) as necessary to satisfy the requirements of the ISFSI (with the exception of physical protection and emergency response services for the FSV ISFSI which are provided under local support agreements).

1.3.4 ORGANIZATION AND MANAGEMENT OF APPLICANT

The Secretary of Energy, by Delegation Order No. 10CFR72.512.1 (signed October 31, 1996) delegated to the Manager, DOE-ID as the Secretary's authorized representative, the authority to perform on the Secretary's behalf as applicant and named holder for the FSV ISFSI license under 10 CFR Part 72. DOE-ID will continue to retain overall responsibility for ISFSI activities, including licensing, operation, modification design and engineering if necessary, and decommissioning, and is responsible for meeting applicable regulatory requirements. DOE-ID will continue to manage and oversee ISFSI operation and decommissioning as necessary to verify compliance with regulatory requirements and license conditions, and to ensure the overall protection of the health and safety of the public, the workers, and the environment.

To exercise its overall responsibility, DOE-ID retains responsibility for and performs independent audits of the ICP contractor's ISFSI Quality Assurance (QA) Program (both the achievement of quality by contractor management and the verification of quality by contractor QA personnel), ensures the requirements to comply with the license conditions for the ISFSI are included in the CWI contract, assesses the performance of the CWI contractor against the terms of the contract and NRC license requirements, retains the responsibility to request and budget funds necessary and sufficient to meet the license requirements of the ISFSI, and retains the authority to revise the ICP contract in the event contract deficiencies are found relative to proper implementation of license conditions.

Pursuant to its contract with DOE-ID, CWI is currently required to manage and operate both the TMI-2 and the FSV ISFSIs in compliance with all applicable NRC requirements and license conditions and is exempt from compliance with DOE Orders that duplicate or overlap NRC regulations. These requirements and responsibilities will be passed to any succeeding contractor as a contract condition throughout the term of the renewed ISFSI license.

1.3.5 FINANCIAL QUALIFICATIONS

As set forth in 10 CFR 72.22(e), the Department of Energy is not required to provide detailed financial information to demonstrate its financial qualifications. DOE requests through the federal budget process the necessary funding for the operation and decommissioning of the ISFSI. License Condition No. 15 for the currently held 10 CFR Part 72 license (SNM-2504) for the FSV ISFSI addresses funding.

1.4 ABBREVIATIONS AND INTENDED FUNCTION CODE DEFINITIONS

1.4.1 ABBREVIATIONS

The acronyms and abbreviations that pertain to the administrative and technical information in this application, Appendices A through D, and Appendices F and G are listed prior to the Table of Contents. The abbreviations that pertain to the environmental information are included in the front of Appendix E, Environmental Report Supplement.

1.4.2 INTENDED FUNCTION CODE DEFINITIONS

The abbreviations and definitions for the subcomponent intended functions used in subsequent sections of this application, including Table 3.2-1 through Table 3.11-1, are presented. Subcomponent intended functions are the specific functions that support the intended function of the structure and component of which they are a part.

- CC – Provides criticality control of spent fuel
- HT – Provides heat transfer
- PB – Directly or indirectly maintains a pressure and/or confinement boundary
- RS – Provides radiation shielding
- SI – Provides structural support, functional support, missile shielding, and or retrievability of important to safety equipment (structural integrity)

1.5 REFERENCES (SECTION 1.0, GENERAL INFORMATION)

1.5-1 10 CFR Part 72, Licensing Requirements for the Independent Storage of Spent Nuclear Fuel, High-Level Radioactive Waste, and Reactor-Related Greater Than Class C Waste, Code of Federal Regulations, NRC

1.5-2 Enclosure to letter from Mr. E. William Brach, NRC, to Mr. W.R. Matthews, Virginia Electric and Power Company, Docket Nos. 72-2 (50-280/281), Preliminary NRC Staff Guidance for 10 CFR 72 License Renewal, March 29, 2001

1.5-3 Attachment to letter from Mr. L. N. Hartz, Virginia Electric Power Company (Dominion), to NRC Document Control Desk, Serial No. 01-367, Surry Independent Spent Fuel Storage Installation, Comments on NRC Preliminary Guidance, June 26, 2001

1.5-4 Letter from J. F. Lucas, Progress Energy to NRC Serial Number RNP-RA/04-0027, "Request for Renewal of Independent Spent Fuel Storage Installation License," dated February 27, 2004

1.5-5 Letter from D. A. Baxter, Duke Energy to NRC, "Oconee Nuclear Station Site-Specific Independent Spent Fuel Storage Installation License Renewal Application," dated January 30, 2008

1.5-6 *Topical Report for the Foster Wheeler Modular Vault Dry Store (M.V.D.S.) for Irradiated Nuclear Fuel, Revision 1*, October 1987

1.5-7 Safety Evaluation Report Related to the Topical Report for the Foster Wheeler Modular Vault Dry Store (M.V.D.S.) for Irradiated Nuclear Fuel, March 1988

1.5-8 NUREG-1567, *Standard Review Plan for Spent Fuel Dry Storage Facilities*, March 2000

1.5-9 Letter from Mr. E. William Brach, NRC, to Ms. B. A. Cook, DOE-ID, Docket No. 72-9, Transfer of Materials License SNM-2504, Fort St. Vrain, Independent Spent Fuel Storage Installation (TAC No. L22388), June 4, 1999

2.0 SCOPING EVALUATION

2.1 INTRODUCTION

A general description of the FSV ISFSI facility is provided in Section 1.2, Facility Description. A more thorough description of the FSV ISFSI facility is contained in the FSV ISFSI SAR (Reference 2.4-1).

DOE's license renewal process for the FSV ISFSI is consistent with the pilot Site-Specific ISFSI license renewal process developed by Dominion (Virginia Electric and Power Company) and the NRC for the Surry Power Station Site-Specific ISFSI and subsequently followed by Progress Energy for the Robinson Nuclear Plant Site-Specific ISFSI license renewal and Duke Energy for the Oconee Nuclear Station Site-Specific ISFSI license renewal.

The FSV ISFSI license renewal methodology follows the Preliminary Guidance for License Renewal for Site-Specific Independent Spent Fuel Storage Installations (Reference 2.4-2) including comments that were provided to the NRC on June 26, 2001 (Reference 2.4-3) by Dominion (Virginia Electric and Power Company). This methodology is patterned after the regulatory philosophy of 10 CFR Part 54, The License Renewal Rule (Reference 2.4-4). This philosophy is summarized in the two principles of license renewal from the Part 54 Final Rule Statements of Consideration published in the Federal Register, 60 Fed. Reg. 22464 (May 8, 1995), and re-stated below:

> *"The first principle of license renewal was that, with the exception of age-related degradation unique to license renewal and possibly a few other issues related to safety only during the period of extended operation of nuclear power plants, the regulatory process is adequate to ensure that the licensing bases of all currently operating plants provides and maintains an acceptable level of safety so that operation will not be inimical to public health and safety or common defense and security. Moreover, consideration of the range of issues relevant only to extended operation led the Commission to conclude that the detrimental effects of aging is probably the only issue generally applicable to all plants. As a result, continuing this regulatory process in the future will ensure that this principle remains valid during any period of extended operation if the regulatory process is modified to address age-related degradation that is of unique relevance to license renewal.*
>
> *The second and equally important principle of license renewal holds that the plant-specific licensing basis must be maintained during the renewal term in the same manner and to the same extent as during the original licensing term. This principle would be accomplished, in part, through a program of age-related degradation management for systems, structures, and components that are important to license renewal ...."*

Based on these principles, and as explained in the preliminary guidance (Reference 2.4-3), license renewal is not intended to impose requirements beyond those that were met by the facility when it was initially licensed by the NRC. Therefore, the current licensing basis (CLB) for the ISFSI will be carried forward through the renewed license period.

During scoping, the SSCs of the ISFSI that are within the scope of license renewal, and require evaluation for the effects of aging, are identified. A description of the scoping process is provided in Section 2.2, Scoping Methodology.

2.2 SCOPING METHODOLOGY

The first step in the license renewal process involved the identification of the in-scope ISFSI SSCs. This was done by evaluating the SSCs that comprise the ISFSI against the following scoping criteria provided in the Preliminary Guidance for License Renewal for Site-Specific Independent Spent Fuel Storage Installations (Reference 2.4-3), with the comments that were provided by Dominion:

Any SSC that meets either of the criteria shall be evaluated further in the aging management review process described later. The categories of SSCs are those that are:

1. *Important to safety, as they are relied upon to:*
   a) *Maintain the conditions required to store spent fuel safely.*
   b) *Prevent damage to the spent fuel during handling and storage.*
   c) *Provide reasonable assurance that spent fuel can be received, handled, packaged, stored, and retrieved without undue risk to the health and safety of the public, as identified in the current licensing basis.*

   These SSCs ensure that these important safety functions are met for (1) criticality, (2) shielding, (3) confinement, (4) heat transfer, and (5) structural integrity.

2. *Classified as not important to safety, but, according to the current licensing basis, whose failure could prevent an important to safety function from being fulfilled or whose failure as a support SSC could prevent an important to safety function from being fulfilled.*

The function performed by an SSC that causes it to be within the scope of license renewal is its intended function.

Also, SSCs which perform ISFSI support functions are generally not within the scope of license renewal. The fuel in storage is considered to be within the scope of license renewal.

Any ISFSI SSC that met either Scoping Criterion 1 or 2 above was determined to be within the scope of license renewal (in-scope), and the function(s) it is required to perform during the extended term was identified. The results of the Scoping evaluation are presented in Section 2.3.

The basic premise of the license renewal scoping process is that the CLB determines which SSCs perform intended functions that meet either Scoping Criterion 1 or 2, as defined above. The following documents comprise the ISFSI CLB:

- Safety Analysis Report (Reference 2.4-1),
- Materials License No. SNM-2504 (Reference 2.4-5),
- Technical Specifications (Reference 2.4-5), and
- Other licensing correspondence as specifically referenced.

The ISFSI SAR provides a description of the ISFSI facility, ISFSI SSCs and their functions, including safety classifications as established by the safety analyses. The Technical Specifications govern the safety, receipt, possession, storage, and transfer of irradiated nuclear fuel at the ISFSI. Additionally, the SER, which summarizes the results of the NRC staff's safety review of the original licensing (Reference 2.4-6), and the SERs associated with the four subsequent amendments were used in the license renewal scoping process.

Other design and design basis documents, as specifically referenced, were consulted as appropriate to further clarify SSC descriptions, classifications, and intended functions.

2.3 SCOPING RESULTS

The SSCs comprising the ISFSI are identified in Table 2.3-1, Scoping Results. Those SSCs meeting Scoping Criterion 1 or 2 are identified in the table as being within the scope of license renewal (Reference 2.4-7).

As indicated in Table 2.3-1, the FSCs, FSC Support Stools, Standby Storage Wells, CHM Raise/Lower Mechanism, CHM FSC Grapple, Charge Face Structure Structural Steel, CLUP, Structural Concrete of the MVDS Building, Concrete Fill Inside the Charge Face Structure, and Fuel in Storage were determined to be within the scope of license renewal and to require further review in the aging management review process. The intended functions performed by the individual subcomponents of these in-scope SSCs are identified in the aging management review summary tables (Tables 3.2-1 through 3.11-1).

Table 2.3-1. Scoping Results

SSC (1)(2)	Criterion 1	Criterion 2	In-Scope
Fuel Storage Containers (FSC)	YES	NO	YES
FSC Support Stools (SS)	YES	NO	YES
Standby Storage Wells (SSW)	YES	NO	YES
Container Handling Machine (CHM) Raise/Lower Mechanism	YES	NO	YES
CHM FSC Grapple	YES	NO	YES
Charge Face Structure Structural Steel	YES	NO	YES
Cask Load/Unload Port (CLUP)	YES	NO	YES
Structural Concrete of the Modular Dry Vault Store (MVDS) Building	NO	YES	YES
Concrete Fill Inside the Charge Face Structure	NO	YES	YES
Fuel in Storage	YES	NO	YES

(1) Refer to Tables 3.2-1 through 3.11-1 for subcomponent intended function(s).

(2) Refer to Section 3.1.5 and the FSV ISFSI SAR, Chapters 3 and 4 for description of each SSC.

2.4 REFERENCES (SECTION 2.0, SCOPING EVALUATION)

2.4-1 Fort St. Vrain Independent Spent Fuel Storage Installation Safety Analysis Report, as amended

2.4-2 Preliminary NRC Staff Guidance for 10 CFR Part 72 License Renewal [for Site-Specific Independent Spent Fuel Storage Installations], U.S. Nuclear Regulatory Commission, May 17, 2001 (Carolina Power and Light Letter Serial No. RRA-01-0054)

2.4-3 Virginia Electric and Power Company, Surry Independent Spent Fuel Storage Installation, Comments on NRC Preliminary Guidance for Part 72 License Renewal, June 26, 2001 (Dominion Letter Serial No. 01-367)

2.4-4 10 CFR Part 54, Requirements for Renewal of Operating Licenses for Nuclear Power Plants, Code of Federal Regulations, U. S. Nuclear Regulatory Commission, 1995

2.4-5 Fort St. Vrain Independent Spent Fuel Storage Installation Materials License No. SNM-2504, Amendment 9, June 14, 2001, Appendix A (Technical

Specifications)

2.4-6 Safety Evaluation Report for Public Service Company of Colorado's Safety Analysis Report for Fort St. Vrain Independent Spent Fuel Storage Installation, U.S. Nuclear Regulatory Commission, Docket 72-9, October 1991

2.4-7 Engineering Design File (EDF) No. 7675, FSV ISFSI Scoping Evaluation for Aging Management Review Process, current revision

3.0 AGING MANAGEMENT REVIEWS

3.1 AGING MANAGEMENT REVIEW METHODOLOGY

The scoping process identified the ISFSI SSCs within the scope of license renewal which require evaluation for the effects of aging in the AMR process. The purpose of the AMR is to assess the in-scope SSCs with respect to aging effects that could affect the ability of the SSC to perform its intended function during the renewed license period. The AMR process involved the following four major steps:

- Identification of in-scope subcomponents requiring AMR (screening),
- Identification of materials and environments,
- Identification of aging effects requiring management, and
- Determination of the activities/programs required to manage the effects of aging.

Each of these steps is discussed in Subsections 3.1.1 through 3.1.4, respectively. Also, the operating experience review for confirmation of the AMR process and the document sources used in the process are discussed in Subsections 3.1.5 and 3.1.6, respectively.

The results of the aging management review for the subcomponents of the ISFSI SSCs that are in the scope of license renewal are provided in the following sections:

- Section 3.2, AMR Results – FSCs
- Section 3.3, AMR Results – FSC Support Stools
- Section 3.4, AMR Results – Standby Storage Wells
- Section 3.5, AMR Results – CHM Raise/Lower Mechanism
- Section 3.6, AMR Results – CHM FSC Grapple
- Section 3.7, AMR Results – Charge Face Structure Structural Steel
- Section 3.8, AMR Results – CLUP
- Section 3.9, AMR Results – Structural Concrete of the MVDS Building
- Section 3.10, AMR Results – Concrete Fill Inside the Charge Face Structure
- Section 3.11, AMR Results – Fuel in Storage

Corresponding tables that summarize the aging management review for these ISFSI

SSCs are located in the respective sections.

The AMRs and TLAA are documented in EDFs.[1] To the extent the EDFs also included recommendations for enhanced or additional aging management activities, the enhanced activities are addressed in Appendix C to this license application.

3.1.1 IDENTIFICATION OF IN-SCOPE SUBCOMPONENTS REQUIRING AMR

The scoping process described in Section 2.0 did not identify the specific subcomponents for the in-scope ISFSI SSCs that require AMR. Therefore, during the first step in the AMR process, the in-scope SSCs were further reviewed to identify and describe the subcomponents that support the SSC intended function. The subcomponents and associated intended functions have been identified by reviewing the documentation sources identified in Subsection 3.1.6.

Subcomponents that perform or support any one of the identified intended functions in a passive manner, without moving parts or a change in configuration or properties, were determined to require an aging management review.

In addition, all in-scope SSC subcomponents identified in the SAR (Reference 3.12-1) were included in the aging management review. Those SSC subcomponents that either do not support an intended function, or perform an intended function by a change in configuration or properties (active), or have their condition monitored at some established frequency, were not specifically screened or excluded from evaluation in the aging management review.

Tables 3.2-1 through 3.11-1 identify the intended functions for the ISFSI subcomponents that were included in the aging management review.

3.1.2 IDENTIFICATION OF MATERIALS AND ENVIRONMENTS

The second step of the AMR process involved the identification of the materials of construction and the environments to which these materials are exposed for the ISFSI subcomponents that required an AMR.

The materials of construction have been identified through a review of pertinent design and/or design basis documents, which are discussed in Subsection 3.1.6. A summary of the materials of construction is provided in Subsection 3.2.2 for the FSC subcomponents, Subsection 3.3.2 for the FSC Support Stool subcomponents, Subsection 3.4.2 for the SSW subcomponents, Subsection 3.5.2 for the CHM

[1] At the time the AMRs were performed, DOE-ID was considering a 30-year renewal period. Accordingly, all AMRs and the TLAA are based on a 50-year operation period for the ISFSI. DOE-ID is only applying for a 20-year license renewal for the FSV-ISFSI.

Raise/Lower Mechanism subcomponents, Subsection 3.6.2 for the CHM FSC Grapple subcomponents, Subsection 3.7.2 for the Charge Face Structure Structural Steel subcomponents, Subsection 3.8.2 for the CLUP subcomponents, Subsection 3.9.2 for the Structural Concrete of the Modular Vault Dry Store Building, Subsection 3.10.2 for the Concrete Fill Inside the Charge Face Structure, and Subsection 3.11.2 for the Fuel in Storage subcomponents. The materials of construction are also reflected in the corresponding aging management review summary tables (Tables 3.2-1 through 3.11-1).

The environments to which components are exposed play a critical role in the determination of potential aging mechanisms and effects. A review of plant documentation, discussed in Subsection 3.1.6, was performed to quantify the environmental conditions to which the ISFSI SSCs are continuously or frequently exposed. The environmental conditions identified during this review include any conditions known to exist on a recurring basis. They are based on operating experience, unless design features have been implemented to preclude those conditions from recurring. Descriptions of the internal and external environments, which have been used in the aging management review, are included in Subsections 3.2.3, 3.3.3, 3.4.3, 3.5.3, 3.6.3, 3.7.3, 3.8.3, 3.9.3, 3.10.3, and 3.11.3 respectively, and are reflected in the corresponding aging management review summary tables.

3.1.3 IDENTIFICATION OF AGING EFFECTS REQUIRING MANAGEMENT

The third step in the AMR process involved the identification of the aging effects requiring management. Aging effects requiring management during the renewed license period are those that could compromise or cause a loss of passive SSC intended function(s). If degradation of a subcomponent would be insufficient to compromise or cause a loss of function, or the relevant conditions do not exist at the FSV ISFSI for the aging effect to occur or propagate, then no aging management is required.

Potential aging effects, presented in terms of material and environment combinations, have been evaluated and those aging effects requiring management determined as discussed in the aging management sections for the respective SSCs. Both potential aging effects that theoretically occur, as well as aging effects that have actually occurred based upon industry and FSV ISFSI operating experience, were considered. The evaluation was applied to subcomponents, regardless of form.

As described above, the environments considered in this evaluation are the environments that the subcomponents normally experience. Environmental stressors that are conditions not normally experienced (such as accident conditions), or that may be caused by a design problem, are considered event-driven situations and have not been characterized as sources of aging. Such event-driven situations would be evaluated and corrective actions, if any, implemented at the time of the event.

Aging effects are the manifestation of aging mechanisms. In order to effectively manage an aging effect, it was necessary to determine the aging mechanisms that are potentially at work for a given material and environment application. Therefore, the AMR process addressed both the aging effects and the associated aging mechanisms. Various mechanisms are only applicable at certain conditions, such as high temperature or moisture, for example. Each identified mechanism was characterized by a set of applicable conditions that must be met for the mechanism to occur or propagate. Given this evaluation process, and as described in the aging management sections for the respective SSCs, each ISFSI subcomponent that was subjected to AMR was evaluated to determine if the potential aging effects/mechanisms were credible considering the material, environment, and conditions of storage.

As described in the aging management review documents (referenced in the aging management sections for the respective SSCs), the compilation of potential aging effects/mechanisms that were considered by DOE for the FSV ISFSI was based in part on FSV ISFSI operating experience. DOE also considered aging effects and mechanisms identified by industry experience at other ISFSIs and in the NRC Preliminary Guidance for License Renewal for Site-Specific Independent Spent Fuel Storage Installations. Potential aging mechanisms also were extracted from various industry documents (e.g. American Concrete Institute (ACI), American National Standards Institute (ANSI), American Society for Metals (ASM), American Society of Mechanical Engineers (ASME), American Society for Testing and Materials (ASTM), Electric Power Research Institute (EPRI), and NRC guidance and NUREGs) for the material/environment combinations applicable to the respective FSV ISFSI subcomponents.

A summary of aging effects requiring management for the subcomponents of the FSCs, FSC Support Stools, SSWs, CHM Raise/Lower Mechanism, CHM FSC Grapple, Charge Face Structure Structural Steel, CLUP, Structural Concrete of the Modular Dry Vault Store Building, Concrete Fill Inside the Charge Face Structure, and Fuel in Storage is provided in Subsections 3.2.4, 3.3.4, 3.4.4, 3.5.4, 3.6.4, 3.7.4, 3.8.4, 3.9.4, 3.10.4, and 3.11.4 respectively. The aging effects that require management during the renewed license period are also reflected in the corresponding aging management review summary tables.

3.1.4 DETERMINATION OF THE ACTIVITIES REQUIRED TO MANAGE THE EFFECTS OF AGING

The final step in the AMR process involved the determination of the Aging Management Activities (AMAs) or Aging Management Programs (AMPs) to be credited or developed for managing the effects of aging. Where appropriate, existing ISFSI inspection and maintenance programs were credited for the management of aging effects that could compromise or cause a loss of component intended function during the renewed license period.

As indicated in Subsections 3.2.4, 3.3.4, 3.5.4, 3.6.4, 3.7.4, 3.8.4, 3.10.4, and 3.11.4 and reflected in the corresponding aging management review summary tables (Tables 3.2-1, 3.3-1, 3.5-1, 3.6-1, 3.7-1, 3.8-1, 3.10-1, and 3.11-1) there are no aging effects requiring management during the renewed license period for the subcomponents of the FSCs, FSC Support Stools, CHM Raise/Lower Mechanism, CHM FSC Grapple, Charge Face Structure Structural Steel, CLUP, Concrete Fill Inside the Charge Face Structure, and Fuel in Storage during the requested license renewal period, although various enhanced inspection, maintenance, monitoring, documentation and other activities have been and continue to be performed for the respective SSCs as recommended in the applicable aging management review documents as referenced.

The AMP for the management of aging of the Structural Concrete of the MVDS Building is described in Subsections 3.9.5 and listed in the corresponding aging management review summary table (Table 3.9-1).

The demonstration of the effectiveness of the AMPs for the SSWs and Structural Concrete of the MVDS Building is discussed in Appendix A, Aging Management Programs.

3.1.5 OPERATING EXPERIENCE REVIEW FOR PROCESS CONFIRMATION

As described in Subsection 3.1.3 and the aging management review documents for the in-scope SSCs (referenced in the AMR sections of this application for the respective SSCs), the potential aging effects for FSV ISFSI material and environment combinations were compiled from common industry and facility operating experience through the use of accepted industry standards and reference materials, including various metallurgical literary references relating specific materials and environments to aging effects and mechanisms. These aging effects/mechanisms were evaluated, as described above, based on the premise that similar materials in similar environments experience similar aging effects and mechanisms.

A further review of industry and facility-specific operating experience for the FSV ISFSI was also performed in order to confirm the applicability of previously identified potential aging effects/mechanisms and to identify any aging effects not previously addressed in aging effect evaluations. This review is described in the aging management review documents cited in this application in the AMR sections for the respective SSCs.

A discussion of operating experience, as it pertains to the effectiveness of AMPs credited with the management of aging, is also contained in the appropriate subsections of Appendix A, Aging Management Programs of this application. The review of operating experience did not identify any potential aging effects and associated mechanisms for the ISFSI beyond those previously identified in the process described in Section 3.1.3. Additionally, the appropriateness of the FSV ISFSI aging management review was confirmed by the operating experience review discussed as applicable for the respective SSCs.

3.1.6 DOCUMENTATION OF SOURCES USED FOR THE AMR PROCESS

The following documents were the primary sources used to determine the safety classifications, intended functions, materials, and environmental conditions for FSV ISFSI subcomponents identified as in-scope for license renewal:

- *Fort St. Vrain Independent Spent Fuel Storage Installation Safety Analysis Report,* as amended (Reference 3.12-1)
- *Fort St. Vrain Nuclear Generating Station Final Safety Analysis Report*, Amendment 14 (Reference 3.12-2)
- *Fort St. Vrain Independent Spent Fuel Storage Installation Materials License No. SNM-2504, Amendment 9, June 14, 2001, Appendix A* (Technical Specifications) (Reference 3.12-3)
- Foster Wheeler Energy Application, Inc. Topical Report for the Modular Vault Dry Store for Irradiated Nuclear Fuel, Revision 1 (Reference 3.12-4)
- *GEC Alsthom Technical Specification Fort St. Vrain Maintenance, Inspection and Monitoring Requirements, Revision C* (Reference 3.12-5)
- *Safety Evaluation Report for Public Service Company of Colorado's Safety Analysis Report for Fort St. Vrain Independent Spent Fuel Storage Installation, October 1991* (Reference 3.12-6)
- *Certificate of Compliance No. 9253, Revision 12, for the TN-FSV Package, Package Identification No. USA/9253/B(U)F-85* (Reference 3.12-7)
- *Safety Analysis Report for the TN-FSV Package* (Reference 3.12-8)

Docketed correspondence between Public Service Company of Colorado and the NRC has also been utilized, as cited in the aging management reviews referenced in the AMR sections for the respective SSCs. Other plant documents such as drawings, technical reports (engineering design files), vendor manuals, and procedures were consulted, as appropriate and as referenced, to further clarify SSC descriptions and intended functions.

The documents listed in Section 2.2, Scoping Methodology, were also used in the AMR process. Lastly, industry topical reports, reference books, and standards were consulted as appropriate for the description and evaluation of aging effects and mechanisms for the respective SSCs, as cited in the aging management reviews referenced in the AMR sections for the respective SSCs.

3.2 AMR RESULTS – FSCs

This section provides the results of the aging management review of the FSCs which were determined to be in the scope of license renewal as identified in Section 2.3, Scoping Results. The information in this section is summarized from EDF-8612

(Reference 3.12-9).

A summary of the results of the aging management review for the FSC subcomponents is provided in Table 3.2-1 at the end of this section. The table provides the following information related to each subcomponent determined to require aging management review: (1) the intended function, (2) the material group, (3) the environment, (4) the aging effects requiring management, and (5) the specific aging management activities that manage those aging effects.

A description of the FSC subcomponents that support an SSC intended function is provided in Subsection 3.2.1, and a summary of the materials and environments for the FSCs is provided in Subsection 3.2.2 and Subsection 3.2.3, respectively. Subsection 3.2.4 and Subsection 3.2.5, respectively, provide a discussion of the aging effects requiring management for the applicable FSC subcomponents and the aging management activities used to manage the effects of aging.

3.2.1 DESCRIPTION OF FSC SUBCOMPONENTS

The FSCs are high integrity containment vessels designed to ASME Section III requirements as described in Chapter 4 of the FSV ISFSI SAR (Reference 3.12-1). The FSCs were proof pressure tested during manufacture and leak tested after being loaded with spent fuel. None of the FSC subcomponents were excluded from the aging management review because all were determined to either support or impact the intended function of the FSC during the renewed license period.

The FSC is a cylindrical carbon steel canister nominally 16 feet long and 18 inches in diameter with a nominal 0.5 inch thick shell. All exterior surfaces of the FSCs are flame sprayed with aluminum to prevent corrosion of the exterior. The FSC provides a containment boundary for the stored fuel. Attached to the FSC canister shell is a nominal 2 inch thick base and an upper flange forging both with a full penetration V-groove weld. A location boss on the base of the FSC is used to engage the FSC Support Stool fixed to the base of the respective vault module.

A nominal 1.5 inch thick FSC container lid has a lifting feature on its inner profile to enable the FSC to be handled. The FSC container lid is bolted to the body of the FSC container with 24 one-half inch steel bolts and sealed with double metal O-rings to provide a high integrity and leak checkable sealing arrangement designed to withstand exposure to radiation during the 40-year ISFSI design life and storage period without the need for maintenance. A sealable O-ring inter-space tapping allows container sealing to be confirmed every five years at six storage locations.

3.2.2 FSC MATERIALS EVALUATED

The materials of construction for FSC subcomponents that are subject to further aging management review include carbon steel (with and without aluminum coating), silver plated Inconel, and alloy steel. The material type of the individual FSC subcomponents is identified in Table 3.2-1.

3.2.3 ENVIRONMENTS FOR THE FSCs

The environments to which the FSCs are exposed are described in Chapter 3 of the FSV ISFSI SAR (Reference 3.12-1) and the original SER (Reference 3.12-6). The FSC surfaces are subjected to decay heat and radiation from the fuel in an air environment. Thermal-hydraulic analysis of the MVDS predicted a maximum FSC temperature of 165 °F. Cooling air temperatures have remained within the MVDS design temperature limits of -32 °F and 120 °F (Chapter 2 of Reference 3.12-1).

Based on the shielding assessment for the MVDS documented in Appendix A7.1-1 of the FSV ISFSI SAR (Reference 3.12-1), the total gamma absorbed dose rate at the internal surface of the FSC is estimated out to 50 years to be between 9E4 rad/h and 8E5 rad/h (Reference 3.12-9). The integrated gamma absorbed dose after 50 years is calculated to be between 4E10 rad and 4E11 rad. Similarly the neutron absorbed dose rate at the FSC is estimated to be $\leq$ 1 mrad/h. The cumulative absorbed neutron dose at the FSC after 50 years is estimated to be between 30 and 500 rad and a fluence of 5E14 neutrons/cm^2.

3.2.4 AGING EFFECTS REQUIRING MANAGEMENT FOR THE FSCs

This section describes the aging effects that could, if left unmanaged, cause degradation of FSC subcomponents and result in compromise or loss of the SSC intended function(s) during the renewed license period. The aging management review results for individual FSC subcomponents are reflected in Table 3.2-1.

Operational history indicates the FSV ISFSI has only been exposed to normal design conditions. Based on the FSC material and environment combinations and consideration of the conditions during extended storage within the 40-year design life of the ISFSI, there are no discovered aging effects and associated mechanism(s) that could lead to degraded performance or condition of the FSCs, hence requiring management, during the proposed license renewal period.

Potential effects that could affect the performance of the FSCs during the license renewal period are loss of material from corrosion, loss of fracture toughness from irradiation, and loss of strength from elevated temperatures (Reference 3.12-6). These potential effects are discussed further. The review of industry and site-specific operating experience discussed in Subsection 3.1.5 did not identify any other aging effects for a FSC during extended storage within the 40-year design life of the ISFSI.

PSCo Engineering Evaluation EE-DEC-0031, Revision A (Reference 3.12-10), as referenced in Chapter 4 of the FSV ISFSI SAR (Reference 3.12-1) and the SER (Reference 3.12-6), determined that corrosion on the internal wall of the FSC due to potential water contained in the graphite fuel elements was not detrimental to the safe function of the FSCs during their 40-year design lifetime. NRC Bulletin 96-04 (Reference 3.12-11) required ISFSI licensees to review FSC materials to determine whether chemical, galvanic or other reactions among these materials, the contents and environment could occur, with consideration for normal, off-normal and accident conditions. In response to NRC Bulletin 96-04, PSCo identified various materials used in the carbon steel FSCs, including an interior primer and grease used with the metal O-rings, and concluded that galvanic cell corrosion is a possible localized corrosion mechanism that could theoretically occur depending on conditions in a FSC (Reference 3.12-12). While galvanic cell corrosion was evaluated along with other potential localized corrosion mechanisms in Revision A of the above-noted Engineering Evaluation EE-DEC-0031, it was considered that small amounts of moisture in the graphite would tend to remain trapped in the graphite, and would not be driven out at the relatively low temperatures that would be expected for fuel blocks stored in the ISFSI (less than 200 °F).

In the event that fuel elements having a significant absorbed water inventory were loaded into a FSC, and the water evaporated out of the graphite and condensed onto the inner surfaces of the FSC, it may be possible for sufficient water to collect in the bottom of a FSC such that a galvanic cell would be formed. This would require concentrations of ions in the standing water so that it served as a suitable electrolyte. With a suitable electrolyte, formation of a galvanic cell is theoretically possible, with the carbon steel functioning as the anode and the bottom graphite fuel element as the cathode, since carbon has a lower oxidation potential than iron. The oxidation reaction would result in corrosion of the carbon steel, with positive iron ions entering the electrolyte solution, and the reduction reaction could involve production of hydrogen gas where graphite contacts the electrolyte. It should be noted that there are no potential ignition sources during spent fuel storage operations. Corrosion of steel by this mechanism, assuming a conservatively high water inventory that evaporates out of the graphite, could not oxidize sufficient iron to prevent the FSC from performing its containment safety function, and from meeting its minimum strength requirements. Any FSC affected by galvanic cell reaction, as well as by general and crevice corrosion mechanisms also considered in Reference 3.12-12 would continue to maintain its structural integrity during the proposed license renewal period.

ASTM C1562 (Reference 3.12-13) indicates that after 20 years of dry storage, the fast neutron fluence at the interior of dry cask storage systems (DCSS) is typically on the order of 1E14 n/cm^2 and that ferritic materials would require at least several orders of magnitude greater neutron fluence to have any significant effect on mechanical properties. Since the neutron fluence at the FSC is about 5E14 neutrons/cm^2 (Reference 3.12-9), the mechanical properties of the FSC ferritic materials should not be affected from radiation exposure for the proposed license renewal period.

In Appendix A3-1.1 of the FSV ISFSI SAR (Reference 3.12-1), the thermal-hydraulic analysis of the MVDS conservatively predicted a maximum FSC temperature of 165 °F.

The FSC was designed to ASME Section III, Division 1, Subsection ND, Class 3 with a design temperature of 302 °F. The maximum predicted thermal load of 165 °F on the FSC materials is well within the thermal design parameter of 302 °F and has no impact to the long term mechanical properties of the FSC materials (Reference 3.12-9).

The ASM Metals Handbook (Reference 3.12-14) indicates that creep is observed in steels at temperatures above about 700 °F. This temperature is well above the maximum predicted FSC temperature of 165 °F and therefore a change in mechanical properties is not expected over the license renewal period. Verification of metallic ‘O’ ring seal performance is performed every five years in six specific storage locations (one per vault) as required in the FSV ISFSI Technical Specifications (Reference 3.12-3).

Video inspections of two vaults were performed in February 2008. Examination of the photographs of the exteriors of the flame spray aluminum coated FSCs located in near proximity to vault positions A-10 and F-12 indicates they are in good condition (Reference 3.12-9).

Section 1.3.2.1 of the FSV ISFSI SAR (Reference 3.12-1) states that the carbon steel body of the FSC is protected from atmospheric corrosion by application, during manufacture, of a flame sprayed coating of aluminum to the outside surfaces. This method of protecting FSCs has been used for many years in Europe, and the technique was validated by the American Welding Society following a 19-year duration test program. The FWEA MVDS Topical Report (Reference 3.12-4) referred to this experience, and NRC approval was given for the use of carbon steel containers in the MVDS where so protected (Reference 3.12-16). The Generic Aging Lessons Learned (GALL) Report (Reference 3.12-15) was reviewed for aluminum performance in general in indoor air environments. No aging effect mechanism for aluminum was discussed in the GALL Report.

Based on a review of the FSC materials of construction and the environments (e.g., relevant conditions and stressors) experienced during extended ISFSI storage, there are no aging effects requiring management during the license renewal period for the FSC and its subcomponents.

3.2.5 AGING MANAGEMENT ACTIVITIES FOR THE FSCs

Since there are no discovered aging effects that could lead to degraded performance or condition of the FSCs, there are no aging effects requiring management during the proposed license renewal period as summarized in Table 3.2-1. Periodic seal leak checks and visual inspections of the vaults will continue to be performed and are credited as ongoing aging management activities (Reference 3.12-17), with tracking and trending of the inspection results as recommended in EDF-8612 (Reference 3.12-9).

3.2.6 AMR CONCLUSION FOR THE FSCs

Reasonable assurance is provided that the intended functions of FSC subcomponents will be maintained under all CLB conditions during the renewed license (extended storage) period.

Table 3.2-1. AMR Results for the FSCs

Subcomponent	Intended Functions	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Body Container - exterior	PB, HT	Carbon steel, aluminum coated	Outside cooling air, radiation, decay heat	None	None
Body Container - interior		Carbon steel, low alloy steel	Air , atmospheric pressure, radiation, decay heat		
Flange and base forging			Air, radiation, decay heat		
Container Lid					
Metal O-rings	PB	Silver-plated Inconel			
Lid bolts	PB, SI	Alloy Steel			

3.3 AMR RESULTS – FSC SSs

This section provides the results of the aging management review of the FSC SSs which were determined to be in the scope of license renewal as identified in Section 2.3, Scoping Results. The information in this section is summarized from EDF-8612 (Reference 3.12-9).

A summary of the results of the aging management review for the FSC SS subcomponents is provided in Table 3.3-1 at the end of this section. The table provides the following information related to each subcomponent determined to require aging management review: (1) the intended function, (2) the material group, (3) the environment, (4) the aging effects requiring management, and (5) the specific aging management activities that manage those aging effects.

A description of the FSC SS subcomponents that support an SSC intended function is provided in Subsection 3.3.1, and a summary of the materials and environments for the FSC SSs is provided in Subsection 3.3.2 and Subsection 3.3.3, respectively. Subsection 3.3.4 and Subsection 3.3.5, respectively, provide a discussion of the aging effects requiring management for the applicable FSC SS subcomponents and the aging management activities used to manage the effects of aging.

3.3.1 DESCRIPTION OF FSC SS SUBCOMPONENTS

Each FSC SS is protected from atmospheric corrosion by application during manufacture of a flame sprayed coating of aluminum to all outside surfaces as described in Chapter 4 of the FSV ISFSI SAR (Reference 3.12-1). The FSC SS accepts the base of the FSC and is fixed to the vault module floor with anchor studs and grout. The weight of the FSC is carried by the SS and will prevent lateral motion during seismic events. The FSC SS Body is fixed to the vault module floor with anchor bolts.

3.3.2 FSC SS MATERIALS EVALUATED

The materials of construction for FSC SS subcomponents that are subject to further aging management review include carbon steel with (SS) and without (anchor studs) aluminum coating and zinc plating (drop in anchor). The material type of the individual FSC subcomponents is identified in Table 3.3-1.

3.3.3 ENVIRONMENTS FOR THE FSC SSs

The FSC SS surfaces are subjected to decay heat and radiation from the fuel in an air environment, but to a much lesser extent than the FSCs due to their location at the lower end of the FSCs. FSC SS surface temperatures are therefore less than the predicted maximum FSC temperature of 165 °F. As discussed in Subsection 3.2.3, cooling air temperatures have remained within the MVDS design temperature limits of -32 °F and 120 °F.

The total gamma absorbed dose rate at the FSC SS external surfaces is less than that estimated for the internal surface of the FSC (<< 8E5 rad/h). The integrated gamma absorbed dose is calculated out to 50 years to be less than 4E11 rad (Reference 3.12-9). Similarly the neutron dose equivalent rate at the FSC SS external surfaces is much less than the 1 mrad/h estimated for the FSC. The cumulative absorbed neutron dose is estimated out to 50 years to be less than 500 rad and fluence less than 5E14 neutrons/cm^2 due to the SS proximity to the FSC.

3.3.4 AGING EFFECTS REQUIRING MANAGEMENT FOR THE FSC SSs

This section describes the aging effects that could, if left unmanaged, cause degradation of FSC SS subcomponents and result in compromise or loss of the SSC intended function(s) during the renewed license period. The aging management review results for individual FSC SS subcomponents are reflected in Table 3.3-1.

Operational history indicates the FSV ISFSI has only been exposed to normal design conditions. Based on the FSC SS material and environment combinations and consideration of the conditions during the requested license renewal period, there are no discovered aging effects and associated mechanisms that could lead to degraded performance or condition of the FSC SSs, hence requiring management, during its

40-year design and the proposed license renewal period. Potential effects that could affect the performance of the FSC SSs during the license renewal period are loss of material from corrosion, loss of fracture toughness from irradiation and loss of strength from elevated temperatures (Reference 3.12-6). These potential effects are discussed further. The review of industry and site-specific operating experience discussed in Subsection 3.1.5 did not identify any other aging effects for a FSC SS during extended storage.

Video inspections of two vaults were performed in February 2008. Examination of the photographs of the exteriors of the flame spray aluminum coated FSC SSs indicates they are in good condition (Reference 3.12-9). No corrosion of the FSC SS anchors was evident. The vaults were dry and generally free of debris. Only small pockets of dirt have accumulated on the vault floor between the FSC SSs. Grout placements under the FSC SSs provide a bearing surface between the FSC SS and the vault floor. The drains formed into the grout placements for draining any moisture between the FSC and SS were clear.

ASTM C1562 (Reference 3.12-13) indicates that after 20 years of dry storage, the fast neutron fluence at the interior of a DCSS is typically on the order of 1E14 n/cm^2 and that ferritic materials would require at least several orders of magnitude greater neutron fluence to have any significant effect on mechanical properties. Since the neutron fluence at the FSC SS is less than the 5E14 neutrons/cm^2 estimated for the FSC due to the SS proximity to the FSC, the mechanical properties of the FSC SS ferritic materials should not be significantly affected from radiation exposure for the proposed license renewal period.

Since the maximum FSC temperature is predicted to be 165 °F, it is reasonable to assume that the maximum FSC SS temperature is less due to the SS location relative to the FSC. With an FSC design temperature of 302 °F, and since the FSC SS is comprised of the same aluminum coated carbon steel material, it is reasonable to assume that the maximum predicted thermal load on the FSC SS materials is well within the thermal design parameter and has no impact to the long term mechanical properties of the FSC SS materials.

The ASM Metals Handbook (Reference 3.12-14) indicates that creep is observed in steels at temperatures above about 700 °F. This temperature is well above the maximum predicted FSC SS temperature; therefore a change in mechanical properties is not expected over the license renewal period.

Section 1.3.2.1 of the FSV ISFSI SAR (Reference 3.12-1) states that the carbon steel body of the FSC (SS inclusive) is protected from atmospheric corrosion by application, during manufacture, of a flame sprayed coating of aluminum to the outside surfaces. This method of protecting FSC SSs has been used for many years in Europe, and the technique was validated by the American Welding Society following a 19-year duration test program. The Generic Aging Lessons Learned (GALL) Report (Reference 3.12-15) was reviewed for aluminum performance in general in indoor air environments. No aging effect mechanism for aluminum was discussed in the GALL Report. The FWEA MVDS Topical Report (Reference 3.12-4) referred to this experience, and NRC approval was given for the use of carbon steel containers in the MVDS where so protected (Reference 3.12-16).

Based on a review of the FSC SS materials of construction and the environments (e.g., relevant conditions and stressors) experienced during extended ISFSI storage, there are no aging effects requiring management during the proposed license renewal period for the FSC SS and its subcomponents.

3.3.5 AGING MANAGEMENT ACTIVITIES FOR THE FSC SSs

Since there are no discovered aging effects that could lead to degraded performance or condition of the FSC SSs, there are no aging effects requiring management during the proposed license renewal period as summarized in Table 3.3-1. Periodic video monitoring of the vaults will continue to be performed and is credited as an aging management activity (Reference 3.12-17), with tracking and trending of the inspection results as recommended in EDF-8612 (Reference 3.12-9).

3.3.6 AMR CONCLUSION FOR THE FSC SSs

Reasonable assurance is provided that the intended functions of the FSC SS and its subcomponents will be maintained under all CLB conditions during the renewed license (extended storage) period.

Table 3.3-1 - AMR Results for the FSC SSs

Subcomponent	Intended Functions	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Support Stool	CC, SI	Carbon steel, aluminum coating	Outside cooling air, concrete and grout embedment[2]	None	None
Anchor studs		Carbon steel			
Drop in Anchor		Carbon steel, zinc plating			

3.4 AMR RESULTS – SSWs

This section provides the results of the aging management review of the SSWs which were determined to be in the scope of license renewal as identified in Section 2.3,

[2] DOE-ID plans to revise EDF-8612 (Reference 3.12-9) to incorporate appropriate discussion and consideration of the FSC SS concrete and grout embedment environment.

Scoping Results. The information in this section is summarized from EDF-8710 and EDF-9194 (References 3.12-18 and 3.12-22).

A summary of the results of the aging management review for the SSW subcomponents is provided in Table 3.4-1 at the end of this section. The table provides the following information related to each subcomponent determined to require aging management review: (1) the intended function, (2) the material group, (3) the environment, (4) the aging effects requiring management, and (5) the specific aging management activities that manage those aging effects.

A description of the SSW subcomponents that support an SSC intended function is provided in Subsection 3.4.1, and a summary of the materials and environments for the DSCs is provided in Subsection 3.4.2 and Subsection 3.4.3, respectively. Subsection 3.4.4 and 3.4.5, respectively, provide a discussion of the aging effects requiring management for the applicable DSC subcomponents, if any, and any aging management activities used to manage the effects of aging.

3.4.1 DESCRIPTION OF SSW SUBCOMPONENTS

There are three SSWs incorporated into the civil structure at the north end of the MVDS adjacent to one of the vault modules. The functions of each SSW as described in Chapter 4 of the FSV ISFSI SAR (Reference 3.12-1) are as follows:

- Allow isolation of a defective FSC from its storage position in the vault module,
- Provide for leak checking of a FSC away from its vault module storage position,
- Provide basic capability to change fuel elements from a FSC to a spare unit in the unlikely event of FSC failure, although the current license does not allow for the handling of individual fuel elements, and
- Provide basic provision to move individual fuel elements from FSCs and relocate these into a shipping cask, although the current license does not allow for the handling of individual fuel elements.

Each SSW consists of a body (including flange and base forging) that is a simple carbon steel closed-ended liner tube set into an enclosure within the civil structure which provides necessary radiation shielding. The tube is designed to house a FSC and support its base in a manner similar to that used in the vault module, but with a base flange instead of a support stool. The exterior surface of the body container is flame sprayed with aluminum to prevent corrosion of the exterior. The SSW container lid (including metal O-rings and bolts) is a top plate at the storage well that allows the positioning and bolting of a charge face isolation valve. The SSW can be closed using a charge face shield plug and sealed using a sealing cover plate. The metal O-rings are comprised of silver-plated Inconel. The lid bolts are made of alloy steel.

3.4.2 SSW MATERIALS EVALUATED

The materials of construction for SSW subcomponents that are subject to further aging management review include carbon steel (with and without an aluminum coating), silver plated Inconel, and alloy steel. The material type of individual SSW subcomponents is identified in Table 3.4-1.

3.4.3 ENVIRONMENTS FOR THE SSWs

Like the FSC and FSC SS surfaces, the SSW surfaces are subjected to decay heat and radiation from the fuel in an air environment as described in Chapter 3 of the FSV ISFSI SAR (Reference 3.12-1) and the original SER (Reference 3.12-6). In this case the decay heat and radiation is attributed to fuel stored in the adjacent vault separated from the SSWs by several feet of concrete and labyrinth cooling ducts. Spent fuel has not been stored in any of the three SSWs. Thermal-hydraulic analysis of the MVDS predicted a maximum SSW temperature of 221 °F, well within the thermal design parameter of 300 °F; hence there has been no impact on the long-term mechanical properties of SSW materials (Chapter 2 of Reference 3.12-1). Without the storage of spent fuel in any of the SSWs, SSWs have been subject to much lower temperatures. Cooling air temperatures have remained within the MVDS design temperature limits of -32 °F and 120 °F.

Based on an analysis of 50 years of operation without storage of spent fuel in a SSW, the gamma radiation dose to SSW components is estimated to range from a maximum of 9E3 rad at the terminal ends of each SSW to a low of 3E3 rad near the center length of each SSW (Reference 3.12-18). The cumulative absorbed neutron dose and fluence are proportionally much less than that calculated for the FSCs and FSC SSs (refer to Sections 3.2.3 and 3.3.3).

The SSWs have been open to air (seals were not installed on the lids) since the facility was placed in service in 1991 allowing airflow in and out of the SSWs due to atmospheric pressure changes. Video inspections of three SSWs performed in February 2008 revealed that moisture from the air has been condensing onto the inside of the SSW walls, running down the vertical face, and pooling in the bottom of the SSW tube (Reference 3.12-18). In February 2009 the SSWs were dried, cleaned, inspected and sealed by reinstalling the SSW lids with dual metal O-rings to prevent further moisture from entering the SSWs.

3.4.4 AGING EFFECTS REQUIRING MANAGEMENT FOR THE SSWs

The video inspections of the SSWs performed in February 2008 revealed that the interior walls of the SSWs showed signs of mild to moderate corrosion (Reference 3.12-18). Mild corrosion was seen in the upper end of the SSW and moderate in the lower end. The curved annular feature in the SSW base forging near the weld between the

SSW shell and base forging had surface corrosion and debris such that the extent of the loss of material due to corrosion could not be visually evaluated.

The GEC Alsthom design calculation for SSW tube corrosion allowance used an internal wall corrosion rate of 0.18 mils/y to evaluate the SSW tube 40 year design life (Reference 3.12-19). GEC Alsthom and PSCo applied this same corrosion rate in corrosion evaluations of the interior surfaces of FSCs (References 3.12-20 and 3.12-21). Additional information regarding FSC corrosion is given in the PSCo response (Reference 3.12-12) to NRC Bulletin 96-04 discussing chemical, galvanic, and other reactions in spent fuel storage and transportation casks (Reference 3.12-11).

Section 2.2.5.2.2 of the FSV ISFSI SER (Reference 3.12-6) states that for rural environments similar to the Fort St. Vrain site, the long term corrosion rate is less than 1.0 mil/y. Applying the 1.0 mil/y rate to the SSW wall leaves a wall thickness after 50 years of 0.326 inches. This thickness far exceeds the minimum nominal wall thickness of 0.0095 inches specified in the GEC Alsthom design calculation for SSW tube corrosion allowance (Reference 3.12-19).

Actual measurements performed at the INL as part of the SSW corrosion assessment indicate a wall thickness of 0.372 inches remaining in the lower portion of the SSW wall after 50 years of atmospheric exposure (Reference 3.12-22). As indicated in Reference 3.12-22, any further loss of material due to corrosion on the internal surfaces of the SSW is not an aging effect requiring management during the license renewal period.

3.4.5 AGING MANAGEMENT ACTIVITIES FOR THE SSWs

The AMR for the SSWs, as documented in Reference 3.12-18, recommended that the configuration of the SSWs be controlled such that the SSW lids (with O-rings installed) are in place unless facility operations require that the SSW lids be removed for installation or removal of items from the SSW or inspection activities. The inside of the SSWs were cleaned to allow for inspection and determination of the extent of the loss of material due to corrosion. Evaluation of the extent of the loss of material has been performed to address its impact on the SSW design life (Reference 3.12-22).

It was determined that an adequate SSW wall thickness will remain for the duration of the license renewal period (Reference 3.12-22). A new inspection frequency has been added to the routine inspection and maintenance program. A SSW inspection procedure has been revised to include a provision for smearing the lid and containment vessel seal surfaces with grease following each inspection since it is required by the GEC Alsthom maintenance specification and it prevents corrosion at carbon steel surfaces. Routine inspection of the SSWs and configuration control of SSW seal surfaces are credited as ongoing aging management activities (Reference 3.12-17). Since there are no other discovered aging effects that could lead to degraded performance or condition of the SSWs, there are no other aging effects requiring management during the proposed license renewal period as summarized in Table 3.4-1.

3.4.6 AMR CONCLUSION FOR THE SSWs

Based on the evaluation of the effects of corrosion, thermal, and radiation aging mechanisms to SSW materials, the results of video inspections, an industry operating experience review, the maintenance history and configuration control of the SSW internal environment, there is reasonable assurance that the intended functions of SSW subcomponents will be maintained under all CLB conditions during the renewed license (extended storage) period.

Table 3.4-1. AMR Results for the SSWs[3]

<table>
<tr><th>Subcomponent</th><th>Intended Functions</th><th>Material Group</th><th>Environment</th><th>Aging Effects Requiring Management</th><th>Aging Management Activity</th></tr>
<tr><td>Body Container -exterior</td><td rowspan="4">PB, HT</td><td>Carbon steel, exterior aluminum coated</td><td rowspan="6">Air, radiation, fuel temperature</td><td rowspan="6">None</td><td rowspan="6">None</td></tr>
<tr><td>Body Container - interior</td><td rowspan="3">Carbon steel</td></tr>
<tr><td>Flange and base forging</td></tr>
<tr><td>Container Lid</td></tr>
<tr><td>Metal O-rings</td><td>PB</td><td>Silver-plated Inconel</td></tr>
<tr><td>Lid bolts</td><td>PB, SI</td><td>Alloy steel</td></tr>
</table>

3.5 AMR RESULTS – CHM RAISE/LOWER MECHANISM

This section provides the results of the aging management review of the CHM Raise/Lower Mechanism which was determined to be in the scope of license renewal as identified in Section 2.3, Scoping Results. Except as otherwise specifically noted, the information in this section is summarized from EDF-8348 (Reference 3.12-23).

A summary of the results of the aging management review for the CHM Raise/Lower Mechanism subcomponents is provided in Table 3.5-1 at the end of this section. The table provides the following information related to each subcomponent determined to require aging management review: (1) the intended function, (2) the material group, (3) the environment, (4) the aging effects requiring management, and (5) the specific aging management activities that manage those aging effects.

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[3] The AMR reflected loss of material and/or seal due to corrosion, and included aging management recommendations, as documented in EDF-8710 (Reference 3.12-18). Table 2.4-1 reflects the time-limited aging analysis, following completion of several of the aging management recommendations and completion of the corrosion analysis, as documented in EDF-9194 (Reference 3.12-22).

A description of the CHM Raise/Lower Mechanism subcomponents that support an SSC intended function is provided in Subsection 3.5.1, and a summary of the materials and environments for the CHM Raise/Lower Mechanism is provided in Subsection 3.5.2 and Subsection 3.5.3, respectively. Subsection 3.5.4 and Subsection 3.5.5, respectively, provide a discussion of the aging effects requiring management for the applicable CHM Raise/Lower Mechanism subcomponents and the aging management activities used to manage the effects of aging.

3.5.1 DESCRIPTION OF CHM RAISE/LOWER MECHANISM SUBCOMPONENTS

The CHM Raise/Lower Mechanism, described in Chapter 4 of the FSV ISFSI SAR (Reference 3.12-1), provides a high integrity means by which an FSC can be raised into or lowered from the machine using a grapple. The mechanism and grapple are designed to be single failure proof so that failure of any single component will not result in the dropping of a FSC. The raise/lower mechanism is comprised of an acme thread lead screw, drive unit, trunnion mounted nut, guide system, duplex chains, sprockets and equalizing beam. The lead screw is mounted between bearings on the outside of the machine body, and is driven from the lower end by a motor through a gearbox. The motor is fitted with a brake. A second (standby) brake is provided between the gearbox and the lead screw. A nut is provided on the lead screw and is mounted in a trunnion block which runs between guide channels up the height of the machine body. The helix angle of the lead screw/nut is chosen to ensure that the nut is self-sustaining.

The FSC grapple is raised and lowered by the lead screw/nut through two duplex chains. The chains are connected at one end to the top of the grapple and at the other end to an equalizing beam mounted at the top of the CHM. Each chain runs over a sprocket mounted on the nut trunnion block and over two sprockets mounted on top of the machine body. Limit switches are housed in the guide channels for position control of the grapple.

Raise/lower mechanism operation is controlled by two latching demand pushbuttons (one for raise and one for lower), and a stop pushbutton to cancel the raise or lower demand. Two position indications are provided, one for upper datum and one for lower datum. The actual position of lower datum is determined by the mode. In normal operation when mechanism lower is demanded, the mechanism will be lowered until the grapple jaws unlocked signal is received, this signal being backed up by the lower datum signal. Similarly, when mechanism raise is demanded, the mechanism will be raised until the upper datum signal is received, this signal being backed up by the ultimate upper limit switch.

3.5.2 CHM RAISE/LOWER MECHANISM MATERIALS EVALUATED

The materials of construction for CHM Raise/Lower Mechanism subcomponents that are subject to further aging management review generally include steel, carbon steel, and copper alloy. The material type of the individual CHM Raise/Lower Mechanism subcomponents is identified in Table 3.5-1.

3.5.3 ENVIRONMENTS FOR THE CHM RAISE/LOWER MECHANISM

The CHM Raise/Lower Mechanism subcomponents are subjected to decay heat and radiation from the fuel in an air environment when the CHM is used to transfer fuel as described in Chapter 3 of the FSV ISFSI SAR (Reference 3.12-1) and the original SER (Reference 3.12-6). The CHM Raise/Lower Mechanism has been operated and stored only at the ambient atmospheric pressure and humidity that are characteristic of Weld County, Colorado (4,791 feet elevation at grade and dry climate). The CHM Raise/Lower Mechanism has not been exposed to any chemical sprays or pools since installation.

During a normal fuel loading cycle a FSC containing fuel was present in the CHM for no more than 74 minutes, or a maximum cumulative time of approximately 321 hours during spent fuel loading. The fuel element decay heat was transferred radially to the FSC and the inner surface of the CHM, then across the lead shielding block to the outer CHM vessel, and to the ambient environment of the charge hall by radiation and natural convection. Loading cycle temperatures calculated for the CHM ranged from 123 °F to 164 °F for the inner CHM vessel, and 121 °F to 135 °F for the outer CHM vessel (Chapter 2 of Reference 3.12-1). Loading cycle temperatures for the CHM Raise/Lower Mechanism would have been less than the temperature range for the outer CHM vessel since the CHM Raise/Lower Mechanism is located outside but adjacent to the outer CHM vessel. The CHM Raise/Lower Mechanism has remained in the charge face of the MVDS where ambient temperature has remained near room temperature for operator comfort and well above 12 °F per Limiting Condition of Operation 3.3.2 (Reference 3.12-3).

An assessment of radiation levels associated with the CHM calculated a gamma dose equivalent rate of 65 mrem/h on contact with the side of the CHM and a calculated neutron dose equivalent rate of 0.5 mrem/h (Reference 3.12-23). Actual dose rates during fuel loading were much lower. Cumulative gamma and neutron absorbed doses to the CHM Raise/Lower Mechanism are therefore estimated to be 39.65 rad and 0.03 rad respectively, or only 40 rad total. The neutron fluence is estimated to be the same as that for an FSC; or 5E14 neutrons/cm^2.

3.5.4 AGING EFFECTS REQUIRING MANAGEMENT FOR THE CHM RAISE/LOWER MECHANISM

The aging management review results for individual CHM Raise/Lower Mechanism subcomponents are reflected in Table 3.5-1. Based on the CHM Raise/Lower Mechanism material and environment combinations, and consideration of the conditions during extended storage, no aging effects and associated mechanism(s) were determined to require management for the applicable subcomponents.

3.5.5 AGING MANAGEMENT ACTIVITIES FOR THE CHM RAISE/LOWER MECHANISM

Since there are no discovered aging effects that could lead to degraded performance or condition of the CHM Raise/Lower Mechanism, there are no aging effects requiring management during the proposed license renewal period as summarized in Table 3.5-1. A more frequent, comprehensive, and documented routine inspection of the CHM Raise/Lower Mechanism is credited as an ongoing aging management activity (Reference 3.12-17), the most recent of which was performed in August 2009 as recommended in Reference 3.12-23.

3.5.6 AMR CONCLUSION FOR THE CHM RAISE/LOWER MECHANISM

Due to the relatively low temperature and radiation levels realized during the ISFSI loading operations, the fact that no potential aging effects have been observed during two 5-year inspections and a more recent (August 2009) inspection, and the projected number of remaining lift/lower cycles being far below that for which the CHM Raise/Lower Mechanism was designed, there are no aging effects requiring management during the renewed license period for the CHM Raise/Lower Mechanism. CHM Raise/Lower Mechanism inspection and preventative maintenance programs, which are consistent with GEC Alsthom requirements and applicable NUREG-1801 guidelines, will continue to provide additional reasonable assurance that the intended functions of the CHM Raise/Lower Mechanism will be maintained under the current licensing basis.

Table 3.5-1 AMR Results for the CHM Raise/Lower Mechanism

Subcomponent	Intended Functions	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Lead Screw	SI	Steel	Temperature and radiation during FSC transfer	None	None
Drive Unit (Shafts)					
Guide Channels		Carbon Steel			
Plate					
Duplex Chains		Steel			
Trunnion and Trunnion Mounted Nut					
Sprocket Pin					
Equalizing Beam		Carbon Steel			
Pins (Fulcrum and Attachment)		Steel			
Chain Attachment		Carbon Steel			
Keys		Steel			
Main Nut		Copper Alloy			

3.6 AMR RESULTS – CHM FSC GRAPPLE

This section provides the results of the aging management review of the CHM FSC Grapple which was determined to be in the scope of license renewal as identified in Section 2.3, Scoping Results. The information in this section is summarized from EDF-8529 (Reference 3.12-24).

A summary of the results of the aging management review for the CHM FSC Grapple subcomponents is provided in Table 3.6-1 at the end of this section. The table provides the following information related to each subcomponent determined to require aging management review: (1) the intended function, (2) the material group, (3) the environment, (4) the aging effects requiring management, and (5) the specific aging management activities that manage those aging effects.

A description of the CHM FSC Grapple subcomponents that support an SSC intended function is provided in Subsection 3.6.1, and a summary of the materials and environments for the CHM FSC Grapple is provided in Subsection 3.6.2 and Subsection 3.6.3, respectively. Subsection 3.6.4 and Subsection 3.6.5, respectively, provide a discussion of the aging effects requiring management for the applicable CHM FSC Grapple subcomponents and the aging management activities used to manage the effects of aging.

3.6.1 DESCRIPTION OF CHM FSC GRAPPLE SUBCOMPONENTS

Along with the CHM Raise/Lower Mechanism, the CHM FSC Grapple described in Chapter 4 of the FSV ISFSI SAR (Reference 3.12-1) provides a high integrity means by which an FSC can be raised into or lowered from the CHM. The grapple is designed to be single failure proof so that failure of any single component will not result in the dropping of a FSC. The FSC grapple is raised and lowered by the lead screw/nut through two duplex chains connected at one end to the top of the grapple and at the other end to an equalizing beam mounted at the top of the CHM. Limit switches are housed in the guide channels for position control of the grapple.

The CHM FSC Grapple is designed to engage and lift an individual FSC containing either six spent fuel blocks, neutron source elements, or twelve reflector blocks. The CHM FSC Grapple is used for normal operation when unloading/loading the transfer cask and vault module. The CHM FSC Grapple function is considered to be important to safety and appropriate levels of documentation and control are applied to its design and manufacture (Reference 3.12-1).

The CHM FSC Grapple is one of two types of grapples which may be used in conjunction with the CHM as described in Chapter 4 of Reference 3.12-1. The other type of grapple is an individual fuel element grapple to handle individual fuel elements, but it is not used since the FSV ISFSI license does not authorize the repackaging of fuel assemblies. An indication of which type of grapple is fitted is provided on the CHM control panel. If a grapple is not fitted, then no indication is given. An indication is also provided to show that the grapple is within the grapple release band, the position of which is determined by the mode. Once the loaded grapple has entered the grapple release band, on further lowering, the jaws become mechanically unlocked. The locked/unlocked condition of the jaws is indicated by two lamps on the control panel. With the grapple jaws in the unlocked state, they may be actuated from the engaged to disengaged state by depressing the disengage pushbutton. The positional status of the jaws is indicated by two lamps on the control panel (engaged or disengaged). When the disengage button is depressed, the disengage lamp is illuminated until either the jaws become disengaged (engaged lap extinguished, disengaged lamp illuminated) or the duty cycle circuitry times it out (engaged lamp remains illuminated, disengaged lamp extinguished).

Once the unloaded grapple has entered the grapple release band, on further lowering the jaws become mechanically unlocked and the jaws automatically engage. The locked/unlocked and disengaged/engaged positional status of the jaws is indicated by lamps on the control panel (locked lamp extinguished, unlocked lamp illuminated, disengaged lamp extinguished, engaged lamp illuminated).

Once a loaded or unloaded grapple is raised from its seated condition in the grapple release band, the jaws automatically mechanically lock, and the state of the jaws remain locked until the grapple re-enters the grapple release band. The following trip conditions prevent the grapple jaws from being disengaged: emergency stop, seismic tremor, three phase supply over voltage, three phase supply under voltage, three phase supply phase imbalance, lower ultimate limit, and raise/lower mechanism over temperature. CHM alarms include an overload alarm when the load exceeds 6,400 lbs with the grapple of a full CHM FSC (the trip level is 3,200 lbs for each of two load cells), and an underload alarm when the load is under 1,800 lbs with the grapple of a full CHM FSC (the trip level is 900 lbs for each of two load cells).

3.6.2 CHM FSC GRAPPLE MATERIALS EVALUATED

The materials of construction for CHM FSC Grapple subcomponents that are subject to further aging management review generally include steel, carbon steel, and alloy steel. The material type of the individual CHM FSC Grapple subcomponents is identified in Table 3.6-1.

3.6.3 ENVIRONMENTS FOR THE CHM FSC GRAPPLE

The CHM FSC Grapple subcomponents are subjected to the same decay heat and radiation from the fuel in an air environment as the CHM Raise/Lower Mechanism. The CHM FSC Grapple has been operated and stored only at the ambient atmospheric pressure and humidity that are characteristic of Weld County, Colorado (4,791 feet elevation at grade and dry climate). The CHM FSC Grapple has not been exposed to any chemical sprays or pools since installation.

During the MVDS loading operation sequence, the CHM FSC Grapple was bearing a load an average of 2.5 hours during a complete FSC loading sequence. With 244 FSCs loaded into the FSV ISFSI between December 1991 and June 1992, the estimated cumulative operating time for the CHM FSC Grapple is 660 hours (Reference 3.12-24). It is reasonably assumed that the fuel element decay heat transferred to the CHM FSC Grapple is similar to that transferred radially to the FSC and the inner surface of the CHM. Loading cycle temperatures calculated for the inner CHM vessel ranged from 123 °F to 164 °F. The CHM FSC Grapple has remained in the charge face of the MVDS where ambient temperature has remained near room temperature for operator comfort and well above 12 °F per Limiting Condition of Operation 3.3.2 (Reference 3.12-3).

During the fuel storage period the CHM is normally bolted down on its storage pad with the CHM FSC Grapple suspended from the CHM Raise/Lower mechanism except during training exercises, maintenance, inspection, and other planned activities. Although GEC Alsthom Engineering Systems recommends that the grapple be removed from the CHM during the storage period for maintenance and storage in accordance with the packaging requirements of ANSI N45.2.2, Packaging, Shipping, Receiving, Storage, and Handling of Items for Nuclear Power Plants (1972), the frequency of use for training purposes, restriction on the use of (hence need to change to) the Individual Fuel Element (IFE) Grapple, and ease of accessibility obviate the benefit of storage inside the CHM.

An assessment of radiation levels associated with the CHM presented both gamma and neutron dose equivalent rates through the side and top of the CHM; a gamma dose equivalent rate of 21 mrem/h through the top of the CHM, and a neutron dose equivalent rate of 0.5 mrem/h (Reference 3.12-24), although actual dose equivalent rates documented during loading were much lower. Cumulative gamma and neutron absorbed doses to the CHM FSC Grapple are therefore estimated to be 12.8 rad and 0.03 rad respectively, or less than 13 rad total (Reference 3.12-24). The neutron fluence is estimated to be much less than the 5E14 neutrons/cm^2 estimated for an FSC.

3.6.4 AGING EFFECTS REQUIRING MANAGEMENT FOR THE CHM FSC GRAPPLE

The aging management review results for individual CHM FSC Grapple subcomponents are reflected in Table 3.6-1. Based on the CHM FSC Grapple material and environment combinations, and consideration of the conditions during extended storage, no aging effects and associated mechanisms were determined to require management for the applicable subcomponents.

3.6.5 AGING MANAGEMENT ACTIVITIES FOR THE CHM FSC GRAPPLE

Since there are no discovered aging effects that could lead to degraded performance or condition of the CHM FSC Grapple, there are no aging effects requiring management during the proposed license renewal period as summarized in Table 3.6-1. A more frequent, documented routine inspection and preventative maintenance of the CHM FSC Grapple, as recommended in Reference 3.12-24, will be performed and is credited as an ongoing aging management activity (Reference 3.12-17).

3.6.6 AMR CONCLUSION FOR THE CHM FSC GRAPPLE

Due to the relatively low temperature and radiation levels realized during the ISFSI loading operations, the fact that no potential aging effects have been observed during two inspections, and the stress margins inherent in the CHM FSC Grapple component design, there are no aging effects requiring management during the renewed license period. Enhanced CHM FSC Grapple inspection and preventive maintenance programs will be performed, consistent with GEC Alsthom requirements, applicable NUREG-1801 guidelines, and the recommendations in Reference 3.12-17. The next CHM FSC Grapple inspection, scheduled to be performed in 2010, will provide reasonable assurance that the intended functions of the CHM FSC Grapple will be maintained under the current licensing basis.

Table 3.6-1 AMR Results for the CHM FSC Grapple

Subcomponent	Intended Functions	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Grapple jaw	SI	Steel	Temperature and radiation during FSC transfer	None	None
Shoulder Pin					
Special Screw					
Frame Arm		Carbon Steel			
Pin		Alloy Steel			
Chain Connector					
Chain Anchor					
Top Plate		Carbon Steel			

3.7 AMR RESULTS – CFS STRUCTURAL STEEL

This section provides the results of the aging management review of the Charge Face Structure (CFS) Structural Steel which was determined to be in the scope of license renewal as identified in Section 2.3, Scoping Results. The information in this section is summarized from EDF-8519 (Reference 3.12-25).

A summary of the results of the aging management review for the CFS Structural Steel subcomponents is provided in Table 3.7-1 at the end of this section. The table provides the following information related to each subcomponent determined to require aging management review: (1) the intended function, (2) the material group, (3) the environment, (4) the aging effects requiring management, and (5) the specific aging management activities that manage those aging effects.

A description of the CFS Structural Steel subcomponents that support an SSC intended function is provided in Subsection 3.7.1, and a summary of the materials and environments for the CFS Structural Steel is provided in Subsection 3.7.2 and Subsection 3.7.3, respectively. Subsection 3.7.4 and Subsection 3.7.5, respectively, provide a discussion of the aging effects requiring management for the applicable CFS Structural Steel subcomponents and the aging management activities used to manage the effects of aging.

3.7.1 DESCRIPTION OF CFS STRUCTURAL STEEL SUBCOMPONENTS

The CFS structural steel described in Chapter 4 of the FSV ISFSI SAR (Reference 3.12-1) provides the support for the CHM and the isolation valves attached to the CHM and CFS steel structure, shield plug at each FSC storage location, and the containment and support for the concrete fill inside the CFS. The concrete fill inside the CFS and the CFS structural steel provides radiological shielding for the fuel. The CFS structural steel and the FSC support stools located on the floor of the MVDS provide the structural support to maintain the vertical and horizontal storage position of the FSCs in the vault module storage array to prevent criticality, maintain seismic stability, and maintain designed airflow cooling in the vault module. The CFS also forms the cover for the MVDS system and the operating floor for the Charge Hall.

3.7.2 CFS STRUCTURAL STEEL MATERIALS EVALUATED

The material of construction for the CFS structural steel subcomponents that are subject to further aging management review is generally carbon steel. The material type of the individual CFS structural steel subcomponents is identified in Table 3.7-1.

3.7.3 ENVIRONMENTS FOR THE CFS STRUCTURAL STEEL

The CFS structural steel is exposed to two separate temperature environments; the temperature environment inside the MVDS and the temperature environment in the Charge Hall. MVDS cooling air temperatures have remained within the MVDS design temperature range of -32 °F and 120 °F. Charge face maximum steady state temperature during MVDS fuel loading is calculated to be 120 °F. Ambient temperature within the charge face, hence CFS structural steel within the Charge Hall, has remained near room temperature for operator comfort and well above 12 °F per Limiting Condition of Operation 3.3.2 (Reference 3.12-3).

Total gamma absorbed dose rate at the external surface of the CFS structural steel is less than that estimated for the internal surface of the FSC (< 8E5 rad/h). The integrated gamma absorbed dose, based on an analysis of 50 years of operation, is less than the 4E11 rad calculated for the FSC (Reference 3.12-9). Similarly the neutron absorbed dose rate at the external surface of the CFS structural steel, based on that estimated for the FSC, is less than 1 mrad/h due to its further location from the FSCs. The cumulative absorbed dose, based on an analysis of 50 years of operation, is estimated to be less than 500 rad and the fluence less than 5E14 neutrons/cm^2 also due its further location from the FSCs.

The CFS structural steel has not been exposed to any chemical sprays or pools since installation; however moisture can condense on the structural steel surfaces and cause corrosion. The structural steel was painted during facility construction to resist corrosion.

3.7.4 AGING EFFECTS REQUIRING MANAGEMENT FOR THE CFS STRUCTURAL STEEL

The aging management review results for individual CFS structural steel subcomponents are reflected in Table 3.7-1 (Reference 3.12-25). Based on the CFS structural steel material and environment combinations, and consideration of the conditions during extended storage, no aging effects and associated mechanisms were determined to require management for the applicable subcomponents.

3.7.5 AGING MANAGEMENT ACTIVITIES FOR THE CFS STRUCTURAL STEEL

Since there are no discovered aging effects that could lead to degraded performance or condition of the CFS structural steel, there are no aging effects requiring management during the proposed license renewal period as summarized in Table 3.7-1. As recommended in EDF-8519 (Reference 3.12-25), a more comprehensive and documented routine inspection of the CFS structural steel is credited as an ongoing aging management activity (Reference 3.12-17).

3.7.6 AMR CONCLUSION FOR THE CFS STRUCTURAL STEEL

There are no aging effects requiring management during the renewed license period for the CFS structural steel. Enhanced, more comprehensive and documented routine inspections are credited to provide reasonable assurance that the intended functions of the CFS structural steel subcomponents will be maintained under all current licensing basis conditions during the renewed license (extended storage) period.

Table 3.7-1 AMR Results for the CFS Structural Steel

Subcomponent	Intended Functions	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Plate	SI, RS, CC	Carbon Steel	Ambient air temperature, decay heat temperature, radiation, indoor uncontrolled and outdoor air, condensation	None	None

3.8 AMR RESULTS – CLUP

This section provides the results of the aging management review of the CLUP which was determined to be in the scope of license renewal as identified in Section 2.3, Scoping Results. Except as otherwise specifically noted, the information in this section is summarized from EDF-8541 (Reference 3.12-26).

A summary of the results of the aging management review for the CLUP subcomponents is provided in Table 3.8-1 at the end of this section. The table provides the following information related to each subcomponent determined to require aging management review: (1) the intended function, (2) the material group, (3) the environment, (4) the aging effects requiring management, and (5) the specific aging management activities that manage those aging effects.

A description of the CLUP subcomponents that support an SSC intended function is provided in Subsection 3.8.1, and a summary of the materials and environments for the CLUP is provided in Subsection 3.8.2 and Subsection 3.8.3, respectively. Subsection 3.8.4 and Subsection 3.8.5, respectively, provide a discussion of the aging effects requiring management for the applicable CLUP subcomponents and the aging management activities used to manage the effects of aging.

3.8.1 DESCRIPTION OF CLUP SUBCOMPONENTS

The CLUP, as described in Chapter 4 of the FSV ISFSI SAR (Reference 3.12-1), provides a position on the charge face above the TCRB for the transfer cask to be seated and prepared for unload/load of its FSC. The function of the CLUP is to support the CHM on the isolation valve above the transfer cask with a total design parameter weight of 173,000 lbs; the combined nominal weight of the transfer cask, CHM, and Charge Face Isolation Valve. Shock absorbers protect the CLUP and FSC from the impact of a FSC dropped into the transfer cask from a nominal height of 4 inches. The seating feature is not designed to withstand the impact of a dropped transfer cask, but it is designed to fail under a nominal load of 500,000 lbs. The cask shield ring provides radiation shielding at the CLUP when the cask closure is removed. The CLUP together with the lower seismic restraint provides seismic restraint for the transfer cask. The isolation valve provides a shielded interface access between the CLUP and the CHM for loading and unloading FSCs.

The CLUP is a carbon steel seating ring and an adaptor plate complete with shield ring. The seating ring is recessed into the charge face onto which the transfer cask can sit via the flange at the top of its body. The seating ring and charge face are slotted to allow the transfer cask to be placed in position by the MVDS crane with minimum lift. The height of lift of the crane hook when lifting the transfer cask is restricted by the dedicated sling length.

The adaptor plate and its shield ring sit in the seating ring around the top of the transfer cask and are positioned by the MVDS crane after the transfer cask has been placed on the seating ring. This configuration provides a continuation of the shield in the slot of the CLUP and a seating feature for the isolation valve identical to that on the vault module charge face.

The isolation valve sits above the transfer cask at the CLUP at the charge face level and is handled into position by the MVDS crane employing a dedicated sling to restrict the height of lift. The valve is a gate valve constructed of carbon steel, driven manually by a screw jack. The valve is located and fixed to the CLUP adaptor plate when in use.

3.8.2 CLUP MATERIALS EVALUATED

The materials of construction for CLUP subcomponents that are subject to further aging management review generally include steel, carbon steel, alloy steel, and cast iron. The material type of the individual CLUP subcomponents is identified in Table 3.8-1.

3.8.3 ENVIRONMENTS FOR THE CLUP

The CLUP has been operated and stored only at the initial ambient atmospheric pressure and humidity conditions described earlier that are characteristic of Weld County, Colorado (Reference 3.12-26). The CLUP has not been exposed to any chemical sprays or pools or any off-normal/accident level events and conditions since installation.

During a normal fuel loading cycle the time duration beginning with the FSC lid uranium shield removal and ending with lifting of the FSC into the CHM is 100 minutes. During this time the CLUP is exposed to radiant decay heat of the FSC with ambient environmental temperatures attributed to both average rated fuel and peak rated fuel of 130 °F. With 244 FSCs loaded into the FSV ISFSI between December 1991 and June 1992 (with 16 FSCs returned for reloading), the estimated ambient environmental temperature cumulative exposure time for the CLUP is 460 hours. An assessment of radiation levels associated with the CLUP, based on gamma and neutron dose equivalent rates calculated for the CHM (92 mrem/h gamma and 0.5 mrem/h neutron), indicate a cumulative absorbed dose of 42 rad, although actual dose rates during loading were much lower.

3.8.4 AGING EFFECTS REQUIRING MANAGEMENT FOR THE CLUP

The aging management review results for individual CLUP subcomponents are reflected in Table 3.8 -1. Based on the CLUP material and environment combinations, and consideration of the conditions during extended storage, no aging effects and associated mechanism(s) were determined to require management for the applicable subcomponents.

3.8.5 AGING MANAGEMENT ACTIVITIES FOR THE CLUP

Because there are no discovered aging effects that could lead to degraded performance or condition of the CLUP, there are no aging effects requiring management during the proposed license renewal period as summarized in Table 3.8-1. A more frequent and comprehensive routine inspection and preventative maintenance of the CLUP, as recommended in Reference 3.12-26, has been implemented and is credited as an ongoing aging management activity (Reference 3.12-17).

3.8.6 AMR CONCLUSION FOR THE CLUP

Due to the relatively low temperature and radiation levels realized during the ISFSI loading operations, the fact that no potential aging effects have been observed during eight inspections performed since license transfer in 1999, and the stress margins inherent in the CLUP component design, there are no aging effects requiring management during the renewed license period. Reasonable assurance is provided that the intended functions of CLUP subcomponents will be maintained under all current licensing basis conditions during the renewed license (extended storage) period.

Table 3.8-1 AMR Results for the CLUP

Subcomponent	Intended Functions	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Cask Support Seat	SI	Carbon Steel	Temperature and radiation during FSC transfer	None	None
Pivot Pin		Alloy Steel			
Disc Springs		Carbon or Alloy Steel			
Support Seat Bracket		Carbon Steel			
Bracket Bolts		Alloy Steel			
Adapter (Cover) Plate		Steel			
Shield Ring		Cast Iron			
Lower Restraint Split Rings		Steel			
Restraint Strut Forks		Alloy Steel			
Restraint Strut Pins					
Restraint Strut Adjustment Screws					

3.9 AMR RESULTS – STRUCTURAL CONCRETE OF THE MVDS BUILDING

This section provides the results of the aging management review of the Structural Concrete of the MVDS Building which was determined to be in the scope of license renewal as identified in Section 2.3, Scoping Results. Except as otherwise specifically noted, the information in this section is summarized from EDF-8672 (Reference 3.12-27).

A summary of the results of the aging management review for the Structural Concrete of the MVDS Building is provided in Table 3.9-1 at the end of this section. The table provides the following information related to the subcomponent determined to require aging management review: (1) the intended function, (2) the material group, (3) the environment, (4) the aging effects requiring management, and (5) the specific aging management activities that manage those aging effects.

A description of the Structural Concrete of the MVDS Building subcomponent that supports an SSC intended function is provided in Subsection 3.9.1, and a summary of the materials and environments for the Structural Concrete of the MVDS Building is provided in Subsection 3.9.2 and Subsection 3.9.3, respectively. Subsection 3.9.4 and Subsection 3.9.5, respectively, provide a discussion of the aging effects requiring management for the Structural Concrete of the MVDS Building subcomponent and the aging management activities used to manage the effects of aging.

3.9.1 DESCRIPTION OF STRUCTURAL CONCRETE OF THE MVDS BUILDING SUBCOMPONENT

The FSV ISFSI Civil Structure, as described in Chapter 4 of the FSV ISFSI SAR (Reference 3.12-1), consists of six Vault Modules, a TCRB, the Charge Face Structure, the Foundation Structure, and three Standby and Neutron Source Storage Wells. Each of the six Vault Modules has the capacity for 45 FSCs. Each FSC is designed to hold six fuel elements, six neutron source elements, or twelve reflector elements. The Civil Structure of each Vault Module provides a minimum of 3 foot 6 inch thick shielding walls around the array of FSCs and the cooling air inlet/outlet duct configuration.

The Vault Module structure is supported by an integral foundation system. Cooling air enters the Vault Module through a mesh covered opening to prevent the ingress of birds, animals, and large debris. The labyrinth arrangement of the inlet structure provides radiological shielding for the stored fuel. Cooling air distribution across the outside of the sealed FSCs is improved by precast concrete collimators set into pockets in the Vault Module structure air inlet walls. The collimators also provide a contribution to the radiological shielding of the stored fuel. The cooling air leaves the Vault Module through a second set of concrete collimators which serve the same functions as those at the inlet, and is exhausted to atmosphere through a concrete cooling air outlet chimney that extends above the charge face. A steel canopy on the top of the cooling air outlet chimney prevents the ingress of rain and snow. The opening of the outlet duct is fitted with mesh. The ambient cooling air does not come into contact with the fuel in the FSCs so that the internal walls of the Vault Module will remain radiologically clean. This canopy structure is designed to withstand the design basis tornado wind speed of 360 mph (Chapter 3, Reference 3.12-1) and the cladding is designed to withstand the maximum normal wind of 110 mph.

The floor of the Vault Module is sloped for drainage and is connected to a gutter that leads to a drain pipe with a valve for sampling, if necessary. Inset and grouted into the

Vault Module floor are the support stools for the FSCs discussed earlier. A construction recess in the top of the Vault Module walls supports the Charge Face Structure. The Charge Face Structure is set into the Vault Module to form the roof of the vault and provide lateral support for the array of FSCs. Bearing pads are cast into the concrete Vault Module recess to transmit charge face structure vertical loads into the civil structure. Lateral loads are transmitted via concrete walls around the outer edges of the Charge Face Structure.

The Charge Face Structure was shop fabricated, filled with concrete (for shielding) at the construction site, and then positioned in the Vault Module. Above and running along each side of the Charge Face Structure, the Vault Module incorporates embedments to support the MVDS crane rails. The embedments transmit loads from the crane to the civil structure. Normal access to the MVDS charge face is via a steel stair case.

The TCRB is alongside and integral with the Vault Module structure. The TCRB provides an access area for the loading and unloading of the transfer cask from its transporter (tractor and trailer). A single road access is provided into the TCRB. This access can be closed with a steel roller shutter door to provide a weather-proof enclosure.

The charge face of the MVDS is formed on one side by the Vault Module cooling air outlet chimney and on the other three sides and the roof by the Charge Hall Structure. The Charge Face Structure is enclosed by a concrete wall up to +34 foot level. Above this level is a steel braced and clad structure supported from the concrete walls and the cooling air outlet chimney. The design of the roof profile has been determined by considerations of wind and snow effects and the performance of the Vault Module cooling system.

The Foundation Structure is designed to support the MVDS, considering the imposed loads created by the structure weight, facility operations, environmental conditions and the Design Basis Earthquake (DBE).

The functions of the MVDS are to provide shielding, passive decay heat removal, structural and seismic support, and environmental protection for the FSCs.

3.9.2 STRUCTURAL CONCRETE OF THE MVDS BUILDING MATERIALS EVALUATED

The materials of construction for the Structural Concrete of the MVDS Building subcomponents that are subject to further aging management review generally include cement, aggregates, and reinforcing steel. The material type of the individual Structural Concrete of the MVDS Building subcomponents is summarized in Table 3.9-1.

3.9.3 ENVIRONMENTS FOR THE STRUCTURAL CONCRETE OF THE MVDS BUILDING

The MVDS Concrete (including subsurface concrete) is subjected to an outdoor environment and decay heat and radiation environments from fuel as described in Chapter 3 of the FSV ISFSI SAR (Reference 3.12-1) and the original SER (Reference 3.12-6). The outdoor environment has been the ambient atmospheric pressure and humidity that are characteristic of Weld County, Colorado. Maximum concrete temperature has been well below the 165 °F predicted for the FSCs. Cooling air temperatures have remained within the MVDS design temperatures of -32 °F and 120 °F.

The integrated absorbed radiation doses, based on an analysis of a 50-year storage period, are estimated to be less than the respective 4E11 rad and 500 rad gamma and neutron absorbed doses calculated for the FSCs. The FSV ISFSI has only been exposed to normal design conditions since the initial license period and has not been exposed to any chemical sprays or pools since installation.

3.9.4 AGING EFFECTS REQUIRING MANAGEMENT FOR THE STRUCTURAL CONCRETE OF THE MVDS BUILDING

This section describes the aging effects that could, if left unmanaged, cause degradation of Structural Concrete of the MVDS Building subcomponents and result in loss of the SSC intended function(s) during the renewed license period. The aging management review results for individual MVDS Building subcomponents are reflected in Table 3.9-1.

Aging effects requiring management during the license renewal period are those that could compromise or cause a loss of passive MVDS Concrete function. If degradation of a subcomponent would be insufficient to compromise or cause a loss of function, or the relevant conditions do not exist at the FSV ISFSI for the aging effect to occur or propagate, then no aging management is required. The potential loss of material from scaling, spalling, rust staining, pitting, and erosion, and loss of mechanical properties from irradiation are the aging effects that have been considered. Cracking and loss of material from pitting is the only aging effect requiring management (Reference 3.12-27). Limited, primarily visual, inspections of readily accessible areas in 2006 and 2009 showed air voids, cracks, staining, and efflorescence characteristic of aging concrete, as well as one 2” by 5” area damaged by probable impact (Reference 3.12-29). However, the FSV ISFSI was generally in excellent condition and no immediate repair issues were identified (References 3.12-17 and 3.12-29).

3.9.5 AGING MANAGEMENT ACTIVITIES FOR THE STRUCTURAL CONCRETE OF THE MVDS BUILDING

Aging management activities for the Structural Concrete of the MVDS Building subcomponents are summarized in Table 3.9-1 and include routine inspections at 5-year intervals and inspections following Off-Normal (tornado or seismic) events as described in References 3.12-17 and 3.12-28.

3.9.6 AMR CONCLUSION FOR THE STRUCTURAL CONCRETE OF THE MVDS BUILDING

Based on evaluation results of the aging effects of loss of material and loss of mechanical properties, review of documented concrete inspections, and as recommended in References 3.12-27 and 3.12-29, more comprehensive routine inspections of the MVDS Concrete and Steel to enable tracking and trending of items designated for such action in Reference 3.12-29 and for which credit is taken as an aging management activity (Reference 3.12-17), reasonable assurance is provided that the intended function of the MVDS Concrete will be maintained under all CLB conditions during the renewed license (extended storage) period.

Table 3.9-1. AMR Results for the Structural Concrete of the MVDS Building

Subcomponent	Intended Functions	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
MVDS Concrete	RS, SI, HT	Cement (including aggregate and reinforcing steel)	Concrete surfaces: Outdoor air, below ground environment[4], thermal and radiation environments from fuel.	Cracking and loss of material	ISFSI Aging Management Program

3.10 AMR RESULTS – CONCRETE FILL INSIDE THE CFS

This section provides the results of the aging management review of the Concrete Fill inside the CFS which was determined to be in the scope of license renewal as identified in Section 2.3, Scoping Results. The information in this section is summarized from EDF-8520 (Reference 3.12-31).

A summary of the results of the aging management review for the Concrete Fill inside the CFS subcomponents is provided in Table 3.10-1 at the end of this section. The table provides the following information related to each subcomponent determined to require aging management review: (1) the intended function, (2) the material group, (3) the environment, (4) the aging effects requiring management, and (5) the specific aging

[4] DOE-ID plans to revise EDF-8672 (Reference 3.12-27) to incorporate appropriate discussion and consideration of the MVDS subsurface concrete and the below ground environment.

management activities that manage those aging effects.

A description of the Concrete Fill inside the CFS that supports the SSC intended function is provided in Subsection 3.10.1. A summary of the materials and environments for the Concrete Fill inside the CFS is provided in Subsection 3.10.2 and Subsection 3.10.3, respectively. Subsection 3.10.4 and Subsection 3.10.5, respectively, provide a discussion of the aging effects requiring management for the Concrete Fill inside the CFS and the aging management activities used to manage the effects of aging.

3.10.1 DESCRIPTION OF CONCRETE FILL INSIDE THE CFS SUBCOMPONENT

As previously discussed in Subsection 3.9.1, the CFS is one part of the FSV ISFSI Civil Structure. A steel structure provides containment and support for the concrete fill inside the CFS as described in Chapter 4 of the FSV ISFSI SAR (Reference 3.12-1). The concrete fill was designed and constructed under the enhanced quality program since it provides the majority of radiation shielding for operations personnel.

3.10.2 CONCRETE FILL INSIDE THE CFS MATERIAL EVALUATED

The material of construction for the Concrete Fill inside the CFS that is subject to further aging management review is the concrete fill itself. There are no strength requirements for the concrete fill, but it is required to fill the voids in the charge face structure with a minimum concrete density of 140 pounds per cubic foot (Reference 3.12-1). The material type of the Concrete Fill inside the CFS is summarized in Table 3.10-1.

3.10.3 ENVIRONMENTS FOR THE CONCRETE FILL INSIDE THE CFS

Chapters 3 of the FSV ISFSI SAR (Reference 3.12-1) and the original SER (Reference 3.12-6) describe the environments that would potentially affect structural concrete as temperature and corrosion. The CFS concrete fill is not a structural component of the MVDS. The concrete fill is enclosed by the CFS structural steel and will not be affected by corrosion unless the CFS structural steel deteriorates due to corrosion. The CFS concrete fill will experience the temperatures that exist in the MVDS and the charge face below the 165 °F predicted for the FSCs. The maximum calculated temperature to which the charge face concrete fill is exposed is 135 °F for the bulk concrete areas and 146 °F at FSC local areas. The maximum concrete temperature recommended in ACI 349 (Reference 3.12-30) is not to exceed 150 °F except for local areas and not to exceed 200 °F for structural components.

The integrated absorbed radiation doses are estimated to be less than the respective 4E11 rad and 500 rad gamma and neutron absorbed doses and 5E14 neutrons/cm^2 calculated for the FSCs for 50 years of storage due to the concrete fill location relative to the FSCs (Reference 3.12-9). This is less than the 1E19 neutrons/cm^2 threshold for detrimental effects on concrete strength and modulus of elasticity.

3.10.4 AGING EFFECTS REQUIRING MANAGEMENT FOR THE CONCRETE FILL INSIDE THE CFS

The aging management review results for Concrete Fill inside the CFS are reflected in Table 3.10-1. Based on the review of the CFS concrete fill materials of construction against the environments experienced during extended ISFSI storage, the results of the inspection and radiation monitoring programs, and an industry operating experience review, there are no aging effects potentially affecting the ability of the CFS concrete fill to perform its intended function (Reference 12.3-31).

3.10.5 AGING MANAGEMENT ACTIVITIES FOR THE CONCRETE FILL INSIDE THE CFS

Since there are no discovered aging effects that could lead to degraded performance or condition of the Concrete Fill inside the CFS, there are no aging management programs or activities required for the Concrete Fill inside the CFS during the renewed license period.

3.10.6 AMR CONCLUSION FOR THE CONCRETE FILL INSIDE THE CFS

There are no aging effects requiring management during the renewed license period for the Concrete Fill inside the CFS. Reasonable assurance is provided that the intended functions of Concrete Fill inside the CFS will be maintained under all CLB conditions during the renewed license (extended storage) period.

Table 3.10-1 AMR Results for the Concrete Fill Inside the CFS

Subcomponent	Intended Functions	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Concrete Fill	RS, SI	Portland cement	Temperature and radiation from fuel, ambient air	None	None

3.11 AMR RESULTS – FUEL IN STORAGE

This section provides the results of the aging management review of the Fuel in Storage which is required to be in the scope of license renewal as identified in Section 2.3, Scoping Results. The information in this section is summarized from EDF-8176 (Reference 3.12-32).

A summary of the results of the aging management review for the Fuel in Storage subcomponents is provided in Table 3.11-1 at the end of this section. The table provides the following information related to each subcomponent determined to require aging management review: (1) the intended function, (2) the material group, (3) the environment, (4) the aging effects requiring management, and (5) the specific aging management activities that manage those aging effects.

A description of the Fuel in Storage subcomponents which support an SSC intended function is provided in Subsection 3.11.1. A summary of the materials and environments for the Fuel in Storage is provided in Subsection 3.11.2 and Subsection 3.11.3, respectively. Subsections 3.11.4 and 3.11.5, respectively, provide a discussion of the aging effects requiring management for the subject Fuel in Storage subcomponents, if any, and any aging management activities used to manage the effects of aging, respectively.

3.11.1 DESCRIPTION OF FUEL IN STORAGE SUBCOMPONENTS

Chapter 4 of the FSV ISFSI SAR (Reference 3.12-1) and the documented aging management review (Reference 3.12-32) describe the Fuel in Storage (FSV HTGR fuel element) source material being in the form of irradiated TRISO coated (Th:U)C_2 and ThC_2 fuel particles inside graphite fuel elements. The fuel elements are graphite hexagonal right prism cylinders manufactured by Great Lakes Carbon Company, and all have the same external nominal dimensions (31.22 in. high, 14.17 in. diameter across the flat faces). The fuel elements differ in nominal weight (either 243 lbs. or 285 lbs.), number of coolant holes (either 57 or 108), reactivity (fuel) holes (either 120 or 210), and neutron source holes. The reported burnup of the FSV HTGR fuel stored at the FSV ISFSI ranges from 72 to 528 MWD/fuel element depending on the segment (fuel cycle) number. The maximum and average fuel element heat generation rates at 859 days after shutdown, using actual burnup, have been calculated to be 101 W and 55 W respectively.

The internal coolant channels within each element are aligned with coolant channels in elements above and below (up to six elements are vertically stacked in a FSC). The active fuel is contained in an array of nominal 0.5 in. diameter holes, which are parallel with the coolant channels, and occupy alternating positions in a triangular array within the graphite structure. The fuel holes are drilled from the top face of the element to within about 0.3 in. of the bottom face. Bonded rods of coated fuel particles are stacked within the holes. The fuel holes and coolant channels are distributed on a triangular array of about 0.74 in. pitch spacing with an ideal ratio of two fuel holes for each coolant channel.

The center control rod fuel element in each region was similar to the surrounding fuel elements, but contains enlarged channels for two control rods and reserve shutdown absorber material. The control rod channels have nominal 9.72 in. centerline spacing and a nominal diameter of 4.00 in. The reserve shutdown channel has a nominal diameter of 3.75 in. Each control rod fuel element contains 120 fuel holes and 57 coolant channels. The fuel holes in the bottom control rod element are nominally 22.3 in. deep. The reserve shutdown absorber channel hole is also nominally 22.3 in. deep.

An engagement hole at the center of each fuel element is provided for handling purposes. The bottom of the fuel handling hole is extended in some of the regular fuel elements to accommodate a neutron source. Three graphite dowels for aligning the individual elements within a column are located on the top face of the fuel element. A normal coolant channel passes through the center of each dowel. Each dowel is threaded into the graphite structure and cemented with a carbonaceous cement designated P-511 also made by Great Lakes Carbon Company. The dowel is made from the same type of graphite as the fuel element structure and has the same extrusion orientation.

The fuel element structural (and moderator) material is conventional nuclear grade H-327 needle-coke graphite for the initial core, the first and second reloads, and half of the third reload. The other half of the third reload and subsequent reloads used H-451 near-isotropic graphite. Low-level impurities in the graphite include boron (< 5 ppm), nitrogen (< 25 ppm), iron (< 100 ppm), titanium and vanadium (< 100 ppm combined), and ash (< 1,000 ppm). The ash consists of material left over from high temperature exposure and is made up of materials such as Al_2O_3, MgO, BeO, CaO, and SiO.

Fuel compacts are loaded in the fuel holes. The fuel compacts are right circular cylinders containing close-packed coated fuel particles bonded together in a low-density graphite matrix. Impurity concentrations of all the compacts in any fuel element include boron equivalent (< 5 ppm), iron (< 500 ppm), sulphur (< 1,200 ppm), titanium (< 50 ppm), vanadium (< 50 ppm), residual hydrogen (< 200 ppm core average), residual ash (< 300 ppm at 900 °C (1,652 °F)), and water (< 400 ppm). Nominal dimensions of the fuel compacts are 0.5 in. outer diameter by 1.94 in. long.

The fuel is in the form of carbide particles, coated with a highly retentive coating, and bonded with a carbonaceous matrix into fuel compacts within the fuel holes. In both the initial core fuel and the first reload cycle fuel this matrix contained a coal tar pitch binder. In the matrix used in the second reload, the binder was changed to a petroleum derived pitch binder. The fuel compacts contain homogeneous mixtures of fissile and fertile particles. The fissile particles contain both thorium and U-235 (93.15% enriched) in a $(Th{:}U)C_2$ kernel composition with either 3.6:1 or 4.25:1 Th:U ratios. The fertile particles contain only thorium in a ThC_2 kernel composition. Average fuel kernel nominal diameter ranges from 140 to 225 microns for fissile particles, and 375 to 525 microns for fertile particles. The fuel particles are coated with a four-layer TRISO coating. The inner layer is a nominal 50 microns thick porous pyrolytic carbon referred to as a buffer layer. The next layer is a nominal 20 microns thick high density isotropic pyrolytic carbon (IPyC). A nominal 20 microns thick layer of SiC, which is highly impervious to metallic fission products, is deposited outside the inner IPyC layer. The outermost layer is a nominal 30 to 40 microns thick strong high density IPyC. The average coated fuel nominal diameter ranges from 380 to 485 microns for fissile particles, and 635 to 805 microns for fertile particles.

In addition to the fuel particles, the standard fuel elements contain a small amount of burnable poison in the form of boron carbide in a carbon matrix. The burnable poison was formed into poison rods and placed in the corner holes of the hexagonal elements. Impurity concentrations are a total concentration ≤ 5,000 ppm for all of the elements combined (Al, Fe, Pb, Ba, Mg, Si, Ca, Mn, Sn, Co, Mo, Sr, Cr, Na, Ti, Cu, Ni, V, Zn). The Fe, Cd, Hf, and S impurity levels are each < 250 ppm. Less than 1 weight percent of the boron is in the oxide form. The boron concentration is > 99 weight percent B_4C.

Each fuel element has a permanent three digit type number engraved on the side of the hex block. This type number identifies the specific contents of the element. In addition, each element has a permanent serial number engraved on the side of the hex block. The serial number is unique for each element and can be used to trace the entire fabrication history of the components within an element.

3.11.2 FUEL IN STORAGE MATERIALS EVALUATED

The material of construction for the subcomponents of the Fuel in Storage that are subject to aging management review are graphite in the fuel elements (including carbonaceous cement in the fuel compacts and boron carbide in some of the elements); and $(Th:U)C_2$, ThC_2, pyrolytic carbon, and silicon carbide in the fuel particles (Reference 3.12-32).

3.11.3 ENVIRONMENTS FOR THE FUEL IN STORAGE

During reactor operation, the fuel and its subcomponents were in a helium environment (Reference 3.12-32). Gas and water tight containment was provided for irradiated fuel elements while in storage at the reactor facility. A dry helium atmosphere maintained at atmospheric pressure or slightly below (i.e. 11 to 12 psia) was provided for the uncanned irradiated fuel elements. The temperature of the fuel elements in storage was maintained below 750 °F to prevent any significant graphite oxidation in the event of air leakage into the storage well. The amount and rate of graphite oxidation is reported to increase as a function of temperature, but at temperatures less than 750 °F the extent of graphite oxidation is relatively small.

During dry storage at the ISFSI, the fuel-in-storage subcomponents that are subject to aging management review are stored in an air environment, with the external surfaces of the graphite fuel blocks being the primary portion of a subcomponent exposed to this environment (Reference 3.12-32). The fuel continues to be cooled to less than the design temperature specification of 750 °F to prevent it from reaching temperatures at which air-graphite reaction could become significant; hence minimal surface corrosion to the fuel elements is expected, and temperatures are far below temperatures at which increased fission product release from the fuel elements would result.

The gamma source term for an average fuel element at the time of loading in the ISFSI was calculated to be 2.97E14 photons/s (Reference 3.12-32), but only 20% of that after

20 years of storage, and less than 15% of that after 40 years of storage. The neutron source term for an average fuel element at the time of loading in the ISFSI was calculated to be 3.31E5 neutrons/s. Since the primary source of neutron radiation is from alpha-neutron and spontaneous fission reactions, the source term is assumed to remain unchanged out to 40 years of storage.

3.11.4 AGING EFFECTS REQUIRING MANAGEMENT FOR THE FUEL IN STORAGE

Based on a review of the fuel-in-storage materials of construction against the environments experienced during extended ISFSI storage, pre-storage fuel test element and fuel inspections, and the graphite fuel storage history at the INL (INTEC) including FSV fuel, there are no aging effects requiring management during the renewed license period for the graphite fuel elements blocks, graphite fuel compacts, and coated fuel particles (Reference 3.12-32). With the in-core design lifetime of the fuel elements being 1,752 Effective Full Power Days (EFPD), and the actual 658 EFPD of operation during the first three segments, and an estimated 945 EFPD of operation during the last six segments, there is a significant safety margin within the fuel element design to ensure sufficient integrity to permit safe storage during the renewed license period. The fuel elements remain stored in a subcritical state in FSCs in a sealed air environment that is compatible with the maximum predicted fuel temperatures and the properties of graphite. Measured fuel storage canister leak rates (less than 1E-3 cc/s), stable radiation environments, and low storage temperatures provide indirect evidence of very limited fuel element surface reactions with no associated fuel degradation.

3.11.5 AGING MANAGEMENT ACTIVITIES FOR THE FUEL IN STORAGE

Since there are no aging effects requiring management of the fuel-in-storage, there are no aging management programs or activities directly credited during the renewed license period for the fuel-in-storage components. In the absence of any aging effects requiring management, it should also be noted that the FSC is the secondary confinement barrier for the fuel-in-storage, the integrity of which is checked on a 5-year frequency throughout the storage period, and will continue to be so during any renewed license period (Reference 3.12-3).

3.11.6 AMR CONCLUSION FOR THE FUEL IN STORAGE

Due to the controlled storage environment and decreasing radiation and temperatures over the extended storage period, and as supported by pre-storage post-irradiation examination of fuel, there are no aging effects requiring management during the renewed license period for the fuel-in-storage subcomponents stored in the ISFSI. Therefore, reasonable assurance is provided that the intended functions of the ISFSI irradiated fuel assemblies will be maintained under current licensing basis conditions during the renewed license period.

Table 3.11-1. AMR Results for the Fuel in Storage

<table>
<tr><th>Subcomponent</th><th>Intended Function</th><th>Material Group</th><th>Environment</th><th>Aging Effects Requiring Management</th><th>Aging Management Activity</th></tr>
<tr><td>Fuel Element Block</td><td rowspan="2">SI, HT, CC, PB</td><td>H-327 needle-coke graphite, H-451 near-isotropic graphite, P-511 carbona-ceous cement</td><td rowspan="3">During reactor operation: helium pressure as high as 700 psia, temperature as high as 1,430 °F, compressive and shear structural loads, radiation. During ISFSI operation: ambient air, temperature less than 750 °F, radiation</td><td rowspan="4">None</td><td rowspan="4">None</td></tr>
<tr><td>Fuel Compacts</td><td>Low-density graphite (coal tar pitch and petroleum derived pitch)</td></tr>
<tr><td>Burnable Poison Rods</td><td>CC</td><td>Boron carbide</td></tr>
<tr><td>Coated Fuel Particles</td><td>PB</td><td>$(Th:U)C_2$, ThC_2, pyrolytic carbon, silicon carbide</td><td>During reactor operation: median 1,500 °F fuel temperature, radiation. During ISFSI operation: fuel temperature less than 750 °F, radiation</td></tr>
</table>

3.12 REFERENCES (SECTION 3.0, AMRs)

3.12-1 Fort St. Vrain Independent Spent Fuel Storage Installation Safety Analysis Report, current amendment

3.12-2 Fort St. Vrain Nuclear Generating Station Final Safety Analysis Report, Amendment 14

3.12-3 Fort St. Vrain Independent Spent Fuel Storage Installation Materials License No. SNM-2504, Amendment 9, June 14, 2001, Appendix A (Technical Specifications)

3.12-4 Foster Wheeler Energy Application, Inc. Topical Report for the Modular Vault Dry Store for Irradiated Nuclear Fuel, Revision 1

3.12-5 GEC Alsthom Technical Specification Fort St. Vrain Maintenance, Inspection and Monitoring Requirements, Revision C

3.12-6 Safety Evaluation Report for Public Service Company of Colorado's Safety Analysis Report for Fort St. Vrain Independent Spent Fuel Storage Installation, October 1991

3.12-7 Certificate of Compliance No. 9253, Revision 12, for the TN-FSV Package, Package Identification No. USA/9253/B(U)F-85

3.12-8 Safety Analysis Report for the TN-FSV Package, current amendment

3.12-9 EDF-8612, FSV ISFSI MVDS Fuel Storage Container and Support Stool Aging Management Review, current revision

3.12-10 PSCo Engineering Evaluation EE-DEC-0031, Corrosion Issues Related to the Interior of the ISFSI Storage Canisters

3.12-11 NRC Bulletin 96-04 dated July 5, 1996 (G-96120), Travers to Addressees, Subject: Chemical, Galvanic, or Other Reactions in Spent Fuel Storage and Transportation Casks

3.12-12 PSCo letter dated August 19, 1996 (P-96071), Crawford to Travers; Subject: NRC Bulletin 96-04

3.12-13 ASTM C 1562, Standard Guide for Evaluation of Materials Used in Extended Service of Interim Spent Nuclear Fuel Dry Storage Systems, Annex Section A1.3

3.12-14 ASM Metals Handbook, Carbon and Alloy Steels, Service Characteristics of Carbon and Alloy Steels, Elevated Temperature Properties of Steels, ASM International 2007

3.12-15 NUREG-1801, Volume 2, Revision 1, Generic Aging Lessons Learned (GALL) Report, Tabulation of Results

3.12-16 NRC letter dated March 23, 1988, Roberts to Pickering (Foster-Wheeler Energy Applications, Inc.); Subject: Limited Proprietary Review of Nuclear Regulatory Commission (NRC) Staff's Final Safety Evaluation Report for the FW Energy Applications, Inc., Topical Report for The Foster Wheeler Modular Vault Dry Store for Irradiated Nuclear Fuel, Revision 1

3.12-17 PLN-2974, FSV ISFSI Maintenance Program, current revision

3.12-18 EDF-8710, FSV ISFSI MVDS Standby Storage Well Aging Management Review, current revision

3.12-19 Design Calculation A4-2.11.4, Calculation Number 4, SSW Tube Corrosion Allowance, GEC Alsthom Engineering Systems Ltd, March 14, 1990

3.12-20 PSCo Engineering Evaluation EE-DEC-0031, Corrosion Issues Related to the Interior of the ISFSI Storage Canisters

3.12-21 Design Calculation A4-2.3.4, Calculation Number 6, FSC Corrosion Allowance, GEC Alsthom Engineering Systems Ltd, March 5, 1990.

3.12-22 EDF-9194, FSV ISFSI MVDS Standby Storage Well Time Limited Aging Analysis, current revision

3.12-23 EDF-8348, Aging Management Review of the FSV ISFSI Container Handling Machine Raise and Lower Mechanism, current revision

3.12-24 EDF-8529, Aging Management Review of the FSV ISFSI Container Handling Machine Fuel Storage Container Grapple, current revision

3.12-25 EDF-8519, FSV ISFSI Aging Management Review of Charge Face Structure Structural Steel, current revision

3.12-26 EDF-8541, Aging Management Review of the FSV ISFSI Cask Load Unload Port, current revision

3.12-27 EDF-8672, FSV ISFSI MVDS Concrete Aging Management Review, current revision

3.12-28 TPR-5589, Inspection of the FSV ISFSI MVDS Building, current revision

3.12-29 EDF-8556, FSV ISFSI Modular Vault Dry Store Concrete and Steel Inspection, current revision

3.12-30 American Concrete Institute 349, Nuclear Safety Structure Code, Appendix A, Thermal Considerations, 1985

3.12-31 EDF-8520, FSV ISFSI Aging Management Review of Concrete Fill Inside the Charge Face Structure, current revision

3.12-32 EDF-8176, Aging Management Review of the Fuel in Storage at the FSV ISFSI, current revision

APPENDIX A

AGING MANAGEMENT PROGRAM

APPENDIX A: AGING MANAGEMENT PROGRAM

A1.0 INTRODUCTION

Appendix A summarizes the activities that manage the effects of aging for ISFSI subcomponents that have been identified in the License Renewal Application (LRA) as being subject to aging management review. The FSV ISFSI Aging Management Program is credited for the FSV ISFSI.

The FSV ISFSI Aging Management Program is discussed in Section A2.0 and provides a description of the AMP which includes an introduction, an evaluation of the AMP in terms of the attributes of an effective aging management program, and a summary.

Tables 3.2-1 through 3.11-1 summarize the results of the AMRs. Except for aging management program elements already credited for managing the aging effects of in-scope SSCs and subcomponents, these tables identify the aging management activities required for managing specific aging effects. The identified aging management program manages the aging effects, or the relevant conditions that could lead to the aging effects, applicable to the subcomponents, and provides reasonable assurance that the integrity of the subcomponent will be maintained under CLB conditions during the renewed license period.

A2.0 EXISTING AGING MANAGEMENT PROGRAM

The FSV ISFSI provides for interim dry storage for irradiated fuel elements. The fuel elements are confined in carbon steel canisters (FSCs) coated with flame-sprayed aluminum to prevent corrosion of the exterior canister surface. FSCs are protected and shielded by a concrete and steel MVDS structure. FSCs rest on carbon steel Support Stools coated with flame sprayed aluminum that are fixed to the vault module floor with anchor studs and grout. SSWs provide operational flexibility for potential FSC faults that might require isolation of a defective FSC, leak checking of a FSC away from its vault module storage position, basic (though unlicensed) capability to change fuel elements from a FSC to a spare unit in the unlikely event of FSC failure, or basic (though unlicensed) capability to move individual fuel elements from FSCs. The SSWs are carbon steel closed-ended liner tube set into an enclosure within the MVDS structure. The exterior surfaces of the SSWs are flame sprayed with aluminum to prevent corrosion of the exterior. Other SSCs, including the MVDS structural concrete, provide heat dissipation, radiation shielding, structural support, and vertical handling throughout the MVDS structure.

The ISFSI Aging Management Program includes the SSCs identified as being in-scope in Table 2.3-1. The purpose of the ISFSI Aging Management Program is to ensure that no significant degradation to the MVDS structural concrete and other in-scope SSCs occurs during the license renewal period. A description of the ISFSI Aging Management Program is provided below using each attribute of an effective aging management program as described in the Preliminary Guidance for License Renewal of Site-Specific Independent Spent Fuel Storage Installations (Reference A.3-1).

A2.1 SCOPE

The scope of the FSV ISFSI Aging Management Program involves monitoring the exterior surfaces of the ISFSI. It includes visual inspection of the accessible concrete and exposed steel. It also includes monitoring area radiation levels, and airborne and loose surface radioactive contamination levels at accessible areas of the ISFSI, and ensuring that the cooling inlet and outlet screens do not become blocked.

A2.2 PREVENTIVE ACTIONS

This is primarily a material condition monitoring program. No other preventive actions are performed unless recommended following routine inspection and scheduled maintenance. Maintaining the cooling inlet and outlet screens free from obstruction is required by Technical Specification 3.1 to ensure cooling air temperatures are not elevated for prolonged periods, the steel and concrete are not subject to related damage, and overheating of the SSC components inside the ISFSI is prevented.

A2.3 PARAMETERS MONITORED OR INSPECTED

Consistent with the NRC guidance that an aging management program should include inspection and monitoring of concrete aging, accessible concrete is visually examined for indication of surface deterioration. Degradation could affect the ability of the concrete to provide support to the FSCs, to provide radiation shielding, or to provide a path for heat transfer from each vault module. The above grade exterior concrete is accessible. The interior concrete and below grade concrete surfaces are inaccessible. Interior concrete is accessible for remote exams as necessary. The above grade exterior concrete is a leading indicator for the interior concrete.

Accessible steel, that is steel on the external surfaces of the SSCs and subject to wetting/moisture, is visually examined in accordance with Reference A.3-2 for the aging effect of loss of material (corrosion). This aging effect could affect the ability of structural steel to perform its intended function.

With the exception of a radioactive source cabinet and a depleted uranium shield plug storage area, there are no posted radiological areas (Radiation, Airborne Radioactivity, or Contamination Areas) at the FSV ISFSI. Quarterly monitoring of radiological conditions in accessible areas of the ISFSI is performed to ensure radiological posting thresholds are not exceeded. If any radiation and contamination levels were to exceed such thresholds, they would be investigated for potential degradation of the ISFSI components. Increased levels could indicate a reduction in the ability of the concrete and steel to provide adequate radiation shielding, or could indicate a breach in the containment function of the FSC. Radiological monitoring results have yet to indicate degradation of ISFSI components that shield radiation or contain radioactive material.

Weekly surveillances are performed to ensure the cooling air inlet and outlet screens are free from obstructions, thereby preventing reduced air flow and potential overheating of the SSC components located inside the ISFSI (Reference A.3-3).

A2.4 DETECTION OF AGING EFFECTS

The examination method used for the accessible concrete and steel is primarily a visual examination performed by qualified personnel on a 5-year frequency (Reference A.3-4). A baseline inspection was performed in 2006 and repeated in 2009 (Reference A.3-5), with subsequent examination frequencies determined by the FSV ISFSI management and engineering personnel based on the condition observed (Reference A.3-2). The frequencies vary, but none exceed ten years. The results of the inspections are discussed for the Operating Experience attribute below.

A2.5 MONITORING AND TRENDING

The surveillance tests for monitoring radiation and contamination levels could identify a crack in the shielding or a loss of the containment function. This surveillance is performed quarterly. If any of the preestablished limits, as described in the respective facility procedures, are exceeded, the FSV ISFSI Facility Manager and the DOE-ID Facility Director are required to be notified.

A2.6 ACCEPTANCE CRITERIA

A facility procedure provides inspection attributes and acceptance standards for steel and concrete that is commensurate with industry codes, standards, and guidelines (Reference A.3-4). MVDS concrete is determined to be Good, Satisfactory, or Poor. Good signifies that the MVDS concrete is free of significant deficiencies or degradation that could lead to the loss of structural integrity, hence acceptable. Satisfactory signifies that surfaces of the MVDS concrete contain deficiencies or degradation that will remain able to perform the design basis function until the next inspection, hence acceptable with deficiencies. Poor signifies MVDS concrete surfaces contain deficiencies or degradation that either compromise or prevent (or could compromise or prevent prior to the next inspection) the ability to perform the design basis function, hence unacceptable.

Acceptance limits for maintaining the cooling inlet and outlet screens free from obstruction are described in the ISFSI Technical Specifications (Reference A.3-3).

A2.7 CORRECTIVE ACTIONS

Corrective actions, including root cause determinations and prevention of recurrence, are performed in accordance with the Corrective Action Program (Reference A.3-6). This may include initiation of a Work Request or Non-Conformance Report (NCR) (Reference A.3-7). Corrective actions are taken in a timely manner in accordance with the significance of the NCR. Deficiencies are either promptly corrected or are evaluated to be acceptable through engineering analysis, which provides reasonable assurance that the intended function is maintained consistent with current licensing basis condition for a minimum period of time until the next required inspection. Increased inspection intervals or increased number of inspection items or locations may be determined to be necessary. There have been no NCRs generated to date related to SSC aging mechanisms and effects.

A2.8 CONFIRMATION PROCESS

Activities initiated in accordance with the implementing documents for the FSV ISFSI Aging Management Program, such as corrective actions, are subject to Quality Assurance Program controls (Reference A.3-8). Thus, the effectiveness is monitored using Corrective Action Program procedures, review and approval processes, and administrative controls, which are implemented in accordance with the requirements of 10 CFR Part 72, Subpart G. Use of these procedures, processes, and controls ensures that corrective actions are taken and are effective.

A2.9 ADMINISTRATIVE CONTROLS

The FSV ISFSI Aging Management Program is subject to DOE-ID and FSV ISFSI Corrective Action and Quality Assurance procedures, review and approval processes, and administrative controls. These are implemented in accordance with the requirements of 10 CFR Part 72, Subpart G and will continue for the renewed license period.

A2.10 OPERATING EXPERIENCE

The FSV ISFSI has been in operation since 1991. Examinations and inspections have been performed in accordance with plant and program procedures. A review of the Corrective Action Program data base indicated that any deficiencies identified for the ISFSI have been administrative and were not related to aging mechanisms and effects of SSCs within the scope of the aging management review.

As discussed in Section 3.1.5, plant specific and industry operating experience, as well as a review of inspection records, did not indicate any aging related deficiencies with the ISFSI components, particularly the concrete associated with the MVDS.

DOE-ID will implement all procedures and measures, as enhanced and recommended in the documented AMRs, for the FSC, SS, SSW, CHM Raise/Lower Mechanism, CHM Grapple, CFS Structural Steel, CLUP, and MVDS structural concrete, as discussed in Appendix C.

A2.12 SUMMARY

Operating experience to date has not indicated any significant degradation to any of the FSV ISFSI components. Inspections and surveillances continue to be implemented that would identify any deficiencies. A Corrective Action Program is in place to track and correct deficiencies in a timely manner.

Continued implementation of the FSV ISFSI Aging Management Program provides reasonable assurance that the aging effects will be managed, such that the intended functions of the ISFSI components, particularly the structural concrete of the MVDS, will be maintained under current licensing basis conditions for the renewed license period.

A3.0 REFERENCES (AGING MANAGEMENT PROGRAMS)

A.3-1 Preliminary NRC Staff Guidance for 10 CFR Part 72 License Renewal [for Site-Specific Independent Spent Fuel Storage Installations], U.S. Nuclear Regulatory Commission, May 17, 2001 (Carolina Power and Light Letter Serial No. RRA-01-0054)

A.3-2 PLN-2974, Fort St. Vrain Independent Spent Fuel Storage Installation Maintenance Program, current revision

A.3-3 Fort St. Vrain Independent Spent Fuel Storage Installation Materials License No. SNM-2504, Amendment 9, June 14, 2001, Appendix A (Technical Specifications)

A.3-4 TPR-5589, Inspection of FSV ISFSI MVDS Building, current revision

A.3-5 EDF-8556, FSV ISFSI Modular Vault Dry Store Concrete and Steel Inspection, current revision

A.3-6 MCP-598, Corrective Action System, current revision

A.3-7 MCP-538, Control of Non-Conforming Items, current revision

A.3-8 Fort St. Vrain Independent Spent Fuel Storage Installation Safety Analysis Report, Chapter 11, as amended

APPENDIX B

TIME-LIMITED AGING ANALYSES

APPENDIX B: TIME-LIMITED AGING ANALYSES (TLAAs)

B1.0 INTRODUCTION

The FSV ISFSI license renewal application uses the methodology described in the Preliminary Guidance for License Renewal for Site-Specific Independent Spent Fuel Storage Installations (ISFSIs), with comments that were provided to the NRC by the Virginia Electric Power Company (Dominion) on June 26, 2001 concerning the Surry ISFSI (Reference B3-1).

B2.0 IDENTIFICATION OF TIME-LIMITED AGING ANALYSES (TLAAs)

TLAAs are defined in the Preliminary Guidance for License Renewal for Site-Specific Independent Spent Fuel Storage Installations (ISFSIs), with comments that were provided to the NRC by the Virginia Electric Power Company (Dominion) (Reference B3-1) as those licensee calculations and analyses that meet all of the following criteria:

- *Involve systems, structures, and components within the scope of license renewal.*

- *Consider the effects of aging.*

- *Involve time-limited assumptions defined by the current licensing term (e.g., 20 years). The defined licensing term should be explicit in the analyses. Simply asserting that the SSC is designed for a service life or ISFSI life is not sufficient. The assertions must be supported by a calculation, analyses, or testing that explicitly include a time limit.*

- *Must be pertinent to a specific safety determination that exists in the CLB. Such analyses would have initially provided the basis for the applicant's initial safety determination, and without the analyses, the applicant may have reached a different safety conclusion.*

- *Must provide conclusions or a basis for conclusions regarding the capability of the SSC to perform its intended function. Analyses that do not affect the intended functions of the SSCs are not considered TLAAs.*

- *Must already be contained or incorporated by reference in the current licensing basis (CLB) for the ISFSI.*

  Facility-specific documentation contained or incorporated by reference in the CLB includes SARs, SERs, Technical Specifications, fire protection plan/hazards analyses, correspondence to and from the NRC, QA plan, and topical reports included as references in the SAR. Calculations and analyses that are not in the CLB or not incorporated by reference are not TLAAs.

B2.1 IDENTIFICATION PROCESS AND RESULTS FOR THE TLAAs

All potential FSV ISFSI specific SSC TLAAs were considered. The ISFSI License Renewal Application for other utility companies including Dominion (Surry ISFSI), Progress Energy (H. B. Robinson ISFSI), and Duke Energy (Oconee ISFSI), and the associated Requests for Additional Information (RAIs), were reviewed to identify any generic ISFSI TLAAs.

For the FSV ISFSI specific TLAAs, GEC Alsthom calculations and evaluations that could potentially meet the six criteria, as described above, were identified. Keyword and manual searches of current license basis documents were performed, including the Materials License, Technical Specifications, SAR, docketed licensing correspondence, and GEC Alsthom reports incorporated by reference in the SAR.

Documents that meet the six criteria listed in Section B2.0 are the time-limited aging analyses for the FSV ISFSI.

B2.2 EVALUATIONS AND DISPOSITION OF THE IDENTIFIED TLAAs

Evaluations of the TLAAs identified using the process described in Section B2.1 were performed to demonstrate that each identified TLAA for the FSV ISFSI has been dispositioned using one of three different approaches described below:

- The analysis will remain valid for the renewed license period.
- The analysis has been projected to the end of the renewed license period.
- The effects of aging on the intended function(s) will be adequately managed for the renewed license period.

The results of these evaluations are discussed below.

B.2.2.1 SSW CORROSION

Video inspections of the SSW interior surfaces performed in February 2008 during the aging management review showed that moisture was condensing onto the inside surfaces of the SSWs and pooling in the bottom. The curved annular groove feature in the bottom of the SSWs where the SSWs bottom plate and cylindrical wall are welded together was found to have a build up of surface corrosion and debris that prevented visual evaluation of loss of material due to corrosion. The conclusion reached, after cleaning the corrosion and debris from the bottom of the SSWs, evaluating the loss of material due to corrosion, and re-evaluating the analyses described in Section 4.2.3.2.3 of the FSV ISFSI SAR (Reference B3-3), was that the SSWs are considered to be capable of performing their intended functions during the proposed 20-year renewal period.

The conditions and assumptions used in the original corrosion analyses have been re-evaluated as documented in Reference B3-3. The re-evaluation concludes that the remaining wall thicknesses of the SSWs under various potential interior corrosion attack mechanisms are much thicker than the minimum required thickness specified in Reference B3-3 and therefore are adequate for continued service throughout the proposed license renewal period. The exterior aluminum coating was also found to be adequate to protect the exterior surface of the SSWs from corrosion for more than 50 years. Based on the assumptions documented in Reference B3-3 and the resulting remaining wall thickness of the SSWs after 50 years, no additional inspection of the internal surfaces of the SSWs is recommended.

B.2.2.2 OTHER POTENTIAL TLAA CONSIDERATIONS

No TLAAs were identified for the Fuel in Storage. The potential aging mechanisms of creep and stress corrosion cracking were considered during the aging management review process documented in Section 3.11, AMR Results – Fuel in Storage.

B2.3 CONCLUSIONS

The SSW corrosion TLAA has been identified and will remain valid for the renewed license period based on the approach that the analysis has been projected beyond the end of the renewed license period.

B3.0 REFERENCES (TIME-LIMITED AGING ANALYSES)

B3-1 Letter Serial No. 01-367, *Surry Independent Spent Fuel Storage Installation, Comments on NRC Preliminary Guidance,* L. N. Hartz to NRC Document Control Desk, June 26, 2001

B3-2 Fort St. Vrain Independent Spent Fuel Storage Installation Safety Analysis Report, current amendment

B3-3 EDF-9194, FSV ISFSI MVDS Standby Storage Well Time Limited Aging Analysis, current revision

APPENDIX C

SAFETY ANALYSIS REPORT SUPPLEMENT AND CHANGES

APPENDIX C: SAFETY ANALYSIS REPORT SUPPLEMENT AND CHANGES

C1.0 INTRODUCTION

This appendix provides a supplement and identifies pertinent changes to the FSV ISFSI SAR. Section C2.0 of this appendix contains changes to the FSV ISFSI SAR made since the June 6, 2009 biennial FSV ISFSI SAR Update Report. Section C3.0 of this appendix contains a proposed new section for the FSV ISFSI SAR to be added under Section 9, Conduct of Operations. The new section 9.7, Aging Management, provides a summarized description of the activities for managing the effects of aging of FSV ISFSI SSCs. This proposed new SAR section will also present the evaluation of time-limited aging analysis (TLAA) for the renewed license period.

C2.0 CHANGES TO EXISTING FSV ISFSI SAR INFORMATION

A biennial FSV ISFSI SAR Update Report was transmitted to the NRC on June 6, 2009 in accordance with 10 CFR 72.48 and 72.70. Chapters 1, 2, 3, 4 and 9 of the FSV ISFSI SAR have since been revised in accordance with 10 CFR 72.48. Chapters 1 and 4 have been revised to remove any reference to a federal repository. Chapters 2 and 3 have been revised to reflect changes to the oil and gas infrastructure within one-half mile of the ISFSI attributed to expansion of the FSV Station generating capacity. Chapter 9 has been revised to reflect a rewrite of the Decommissioning Plan. The changes will be summarized in the next biennial FSV ISFSI SAR Update Report scheduled for June 2011, or as requested to support the license renewal application.

C3.0 NEW FSV ISFSI SAR SECTION

The following information will be integrated into the FSV ISFSI SAR Section 9.7 to document aging management programs credited in the FSV ISFSI license renewal review, and time-limited aging analyses evaluated to demonstrate acceptability during the period of extended operation. The following information will be numbered sequentially within the new FSV ISFSI SAR Section 9.7, Aging Management.

C3.1 FSV ISFSI AGING MANAGEMENT PROGRAM

An assessment of the FSV ISFSI inspection and monitoring activities identified an existing activity necessary to provide reasonable assurance that a FSV ISFSI component within the scope of license renewal will continue to perform its intended functions consistent with the CLB for the renewal period. The FSV ISFSI Aging Management Program involves monitoring the exterior surface of the MVDS concrete. It includes visual inspection of the accessible concrete (including below grade concrete, if exposed during excavation) and any exposed steel embedments and attachments. It also includes monitoring the area radiation and loose surface contamination levels at selected areas of the FSV ISFSI. This is primarily a condition monitoring program, however, preventive actions include a weekly surveillance to ensure MVDS cooling inlet and outlet screens are not obstructed.

Subsequent to the aging management reviews, and as discussed in Section 3.0 of the license renewal application, a number of technical procedures used for the inspection and maintenance of several in-scope SSCs (FSC, SS, SSW, CHM Raise/Lower Mechanism, CHM FSC Grapple, CFS Structural Steel, CLUP, and MVDS Structural Concrete) have been enhanced to include more comprehensive inspection criteria, remote video inspection, tracking and trending of aging conditions, increased inspection frequencies, documentation, engineering evaluations and compliance with GEC Alsthom specifications. DOE-ID will implement all measures and enhanced procedures recommended in the AMRs.

C3.2 TIME-LIMITED AGING ANALYSIS FOR SSW CORROSION

This section discusses the results of the TLAA for the SSW evaluated for license renewal. The evaluation has demonstrated that the analysis has been projected beyond the end of the renewed license period. As stated earlier in Section 3.4.4 of this application, the results of the TLAA indicate a wall thickness of 0.372 inches remaining after 50 years of atmospheric exposure. This thickness exceeds the minimum wall thickness of 0.0095 inches specified in the GEC Alsthom design calculation for SSW tube corrosion allowance. Any further loss of material due to corrosion on the internal surfaces of the SSW is not an aging effect requiring management during the license renewal period.

C4.0 REFERENCES (ISFSI SAR SUPPLEMENT AND CHANGES)

None

APPENDIX D

TECHNICAL SPECIFICATIONS CHANGES

APPENDIX D: TECHNICAL SPECIFICATIONS CHANGES

D1.0 INTRODUCTION

10 CFR 72.42 provides the requirements for renewal of an ISFSI license. The Preliminary Guidance for License Renewal for Site-Specific Independent Spent Fuel Storage Installations (ISFSIs), with comments submitted by Virginia Electric and Power Company (Dominion) on June 26, 2001, provides that an application for license renewal should include any Technical Specifications changes or additions that are necessary to manage the effects of aging during the renewal period and should comply with applicable requirements of 10 CFR 72.44. Review of the information provided in the FSV ISFSI license renewal application and in the FSV ISFSI Technical Specifications has confirmed that no changes to the FSV ISFSI Technical Specifications are needed to manage the effects of aging during the renewal period. This appendix does however provide in Section D2.0 proposed editorial changes to the FSV ISFSI Technical Specifications.

D2.0 PROPOSED CHANGES TO EXISTING FSV ISFSI TECHNICAL SPECIFICATIONS INFORMATION

The proposed editorial changes to the FSV ISFSI Technical Specifications are summarized.

- In the Table of Contents:
  - Add “Section 3.1.1, MVDS Cooling Inlet and Outlet” and corresponding page number “3.1-1”.
  - Add “Handling” to title of Section 3.2.2.
  - Align Section 4.2 along the left page margin.
  - Add “Section 4.2.1, Fuel Storage Container” and corresponding page number “4.0-1”.
  - Add “Section 4.2.2, Modular Vault Dry Store” and corresponding page number “4.0-1”.
  - In Section 5.5.1 title change “Specification” to “Specifications”.
  - In Section 5.5.3 title add “and Oil”

- On pages 3.3-1 and 4.0-1 add “6” to Amendment No.

- In LCO 3.3.2 change “12F” to 12 °F”.

- In Section 4.2.1 change “Canister” to “Container” in title and “Canisters” to “Containers” in paragraph.

- In Section 5.4.1, last sentence delete “Engineering and Environmental”.

- In Section 5.5.2, Step 6 delete “the Bases implemented without prior NRC approval shall be provided to the NRC on a frequency consistent with” and change “72.70(b)” to “72.70(c)(6)”.

Red-line/strike-out pages of the proposed editorial changes will be provided under separate cover.

D3.0 REFERENCES (ISFSI TECHNICAL SPECIFICATIONS SUPPLEMENT AND CHANGES)

None

APPENDIX E

ENVIRONMENTAL REPORT SUPPLEMENT

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ABBREVIATIONS/ACRONYMS

ACRONYMS AND ABBREVIATIONS	
AEC	Atomic Energy Commission
CFR	Code of Federal Regulations
CSU	Colorado State University
DOE	Department of Energy
ER	Environmental Report
FSV	Fort St. Vrain
FWEA	Foster Wheeler Energy Applications
HTGR	High Temperature Gas-Cooled Reactor
ISFSI	Independent Spent Fuel Storage Installation
MVDS	Modular Vault Dry Store
NRC	Nuclear Regulatory Commission
PSCo	Public Service Company of Colorado
SAR	Safety Analysis Report
TLD	Thermoluminescent Dosimeter

E1.0 PURPOSE OF THE FACILITY

E1.1 INTRODUCTION

In 1970 Public Service Company of Colorado (PSCo) submitted an Environmental Report (Reference E1.3-1) to the Atomic Energy Commission (AEC) in support of an operating license being issued for Fort St. Vrain (FSV) Nuclear Generating Station. The AEC issued a Final Environmental Statement (Reference E1.3-2) allowing the construction and operation of FSV Nuclear Generating Station.

The Independent Spent Fuel Storage Installation (ISFSI) was constructed and located on PSCo owner controlled property and within the FSV exclusion area boundary (refer to Figure 2.1-1 of Reference E1.3-3). On November 4, 1991 PSCo received a twenty year, renewable, NRC License pursuant to 10 CFR 72 (Materials License No. SNM-2504) to receive, possess, store, and transfer FSV spent fuel in the ISFSI. PSCo began loading the ISFSI with FSV spent fuel on December 26, 1991. Loading of FSV spent fuel into the ISFSI was completed on June 10, 1992. In 1995 the Department of Energy (DOE) notified the Nuclear Regulatory Commission (NRC) of its intent to procure the FSV ISFSI from PSCo, to take possession of the fuel stored in the FSV ISFSI, and to transfer the license to DOE. A contract modification between DOE and PSCo (Reference E1.3-6) was executed to implement an agreement in principle, which provided for DOE to take title of the FSV fuel stored in the ISFSI. This DOE owner controlled property is referred to as the “site” throughout the FSV ISFSI Environmental Report. The site was previously included in the evaluations performed in References E1.3-1 and E1.3-2.

This FSV ISFSI Environmental Report Supplement describes the environmental effects associated with the continued operation of the FSV ISFSI. The continued operation of the FSV ISFSI will not significantly affect the environment as previously evaluated in References E1.3-1 and E1.3-2, but for a longer duration.

This Environmental Report Supplement has been prepared to meet the requirements of 10 Code of Federal Regulations (CFR) 72.34 (Reference E1.3-4) and Subpart A of 10 CFR 51 (Reference E1.3-5).

E1.2 PURPOSE OF THE FACILITY

The High Temperature Gas Cooled Reactor (HTGR) at FSV was permanently shut down in August 1989 and planned for decommissioning by removing the fuel and other radioactive reactor components. Storage was required for up to 1,482 fuel elements, up to 37 keyed top reflector control rod elements, and up to 6 neutron source elements. Facilities that were to be used for this purpose at the Idaho National Engineering Laboratory were no longer available. Therefore, interim storage became and remains necessary in the form of an onsite ISFSI.

To meet this requirement the Modular Vault Dry Store (MVDS) system was chosen to store the FSV HTGR spent fuel and radioactive waste associated with storing spent fuel.

Reference E1.3-3 describes the ISFSI that provides safe vertical storage of the spent fuel from the FSV HTGR.

E1.3 REFERENCES

E1.3-1 Fort St. Vrain Nuclear Generating Station, Applicant's Environmental Report, Operating License Stage, dated December 1970

E1.3-2 Final Environmental Statement Related to The Operation of the Fort St. Vrain Nuclear Generating Station of Public Service Company of Colorado, Docket Number 50-267, dated August, 1972

E1.3-3 Fort St. Vrain Independent Spent Fuel Storage Installation Safety Analysis Report.

E1.3-4 10 CFR 72, "Licensing Requirements for the Independent Storage of Spent Nuclear Fuel and High-Level Radioactive Waste"

E1.3-5 10 CFR 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions"

E1.3-6 Contract No. DE-AC07-96-ID13425, February 9, 1996

E2.0 THE SITE AND ENVIRONMENTAL INTERFACES

E2.1 GEOGRAPHY AND DEMOGRAPHY

E2.1.1 SITE LOCATION AND DESCRIPTION

The FSV site is located in Weld County, Colorado, approximately 3 1/2 miles northwest of the town of Platteville and 35 miles north of the city of Denver. A controlled area boundary fence surrounds the ISFSI facility. Detailed information regarding the location and description is contained in the ISFSI SAR, Sections 2.1.1 and 2.1.2 (Reference E2.8-1).

E2.1.2 POPULATION DISTRIBUTION

The most recent census performed in 2000 indicates the population density in the rural area surrounding the site is relatively low. The total population within a 5 mile radius of the site was 5,172. Platteville had a population of 2,370. The nearest population centers with populations greater than 25,000 were Longmont with a population of 71,093, Greeley with a population of 76,930, and Loveland with a population of 50,608. The nearest boundaries of Longmont, Greeley, and Loveland are each about 14 miles west and north from the ISFSI location (Reference E2.8-3). A population breakdown by race for Weld County and Colorado is provided in Table E2-2 along with median household income. Additional information on the population distribution is contained in the ISFSI SAR, Section 2.1.3 (Reference E2.8-1).

Table E2-1. Race Breakdown and Income Level

Subject	Weld County	Colorado
White (Hispanic or Latino)	81.7% (27.0%)	82.8% (17.1%)
Black or African American	0.6%	3.8%
American Indian and Alaska Native	0.9%	1.0%
Asian	0.8%	2.2%
Native Hawaiian and Other Pacific Islander	0.1%	0.1%
Other Race	13.3%	7.2%
Multiple Race	2.7%	2.8%
Median Household Income	$42,321	$47,203

E2.1.3 USE OF ADJACENT LANDS AND WATERS

Land use within a 5 mile radius is predominantly agricultural. The major farm products include corn, sugar beets, vegetables, beef and dairy cattle, sheep and turkeys. Situated on the agricultural land is a natural gas and oil industry infrastructure consisting of active and inactive gas wells, collector pipes, transmission pipelines, and feeder pipes. Industrial facilities and manufacturing activities are primarily located in the town of Platteville.

The major waterways are the South Platte River and the St. Vrain Creek neither of which is large enough to be used for transportation or boating. These two waterways supply the majority of the irrigation water for the agricultural lands.

A more detailed description of land and water use is contained in ISFSI SAR Sections 2.1.4 and 2.2 (Reference E2.8-1).

E2.2 ECOLOGY

E2.2.1 GENERAL ENVIRONS

The ecology for the ISFSI facility is described in Reference E2.8-2. The land in the vicinity is used predominantly for agricultural purposes. The major disruption of the natural habitat took place when the land was converted to agricultural uses.

The ISFSI site, including the access road, constitutes approximately 20 acres. A description of environmental impact of the ISFSI operation on the terrestrial and aquatic ecology is contained in Section E5.

E2.3 METEOROLOGY

E2.3.1 REGIONAL CLIMATOLOGY

The general climate in this region is characterized as semi-arid. Annual precipitation averages 10 to 15 inches which occurs mostly in the spring and summer. Snowfall in the winter months can be significant, but is usually dissipated in a few days.

Light winds generally occur with the greatest frequency out of the north by northeast segment. Higher velocity winds (less than 50 mph) do occur during various atmospheric disturbances. Winds tend to be strongest in the late winter and spring, the season with high chinook frequency, and again in the summer, when thunderstorms occur frequently.

High temperature conditions can occur in the summer months (in excess of 100 °F) to a low of well below 0 °F in the winter months. Considerable variation in temperature from night to day can occur depending on atmospheric conditions (cloud cover and thermal radiation losses).

The weather is generally mild; however tornadoes and other extreme and severe weather conditions do occur in the vicinity. A more detailed description of the general climate and weather extremes is contained in the ISFSI SAR Section 2.3 (Reference E2.8-1).

E2.3.2 LOCAL METEOROLOGY

A detailed description of the local meteorology data base is contained in the ISFSI SAR Section 2.3.2 (Reference E2.8-1).

E2.4 HYDROLOGY

E2.4.1 SITE AND FACILITY

The centerline of the MVDS is located approximately 1,500 feet northeast of the decommissioned FSV Reactor Building. The ISFSI controlled area boundary is elliptical and covers an area approximately 816 feet by 663 feet. The top of the MVDS foundation is at an elevation of approximately 4,781 feet above mean sea level. The grade immediately surrounding the MVDS foundation and vertical structure slopes gently away with the use of a concrete apron to allow for adequate drainage and to prevent soil erosion. The fuel storage containers are stored in a vertical position with the top of the container at an approximate elevation of 4,798 feet.

Flood hazards at the ISFSI facility are discussed in ISFSI SAR Sections 2.4.3 and 3.2.2 (Reference E2.8-1). Although the elevations of the 100 year and 500 year flood planes are not specified in the ISFSI SAR, the grade elevation of the ISFSI would be above the high water mark of the maximum flood discharge of the South Platte River.

E2.4.2 SURFACE HYDROLOGY

The ISFSI facility is located approximately 2 miles south of the confluence of the South Platte River and the St. Vrain Creek (refer to Figure E2-1). These are the main surface water features in the vicinity. Several irrigation ditches also traverse portions of the site area. Both of the above main waterways have flow towards the north. Larger flows occur during late spring and early summer due to the melting winter snows. Many ditches take water out from these waterways to the lowlands for irrigation. Much of this water seeps down to the underlying sands and gravel, joins the water table, and flows back underground to join the rivers (refer to Section 2.5.1.3 of Reference E2.8-1).

E2.4.3 SUBSURFACE HYDROLOGY

As discussed in the previous section, ground water from irrigation and surface seepage will join the water table and flow back to join the rivers. The local bedrock is essentially impervious to water percolation; therefore, the general ground water flow will follow the downward slope of the bedrock surface. In the site area, the bedrock slopes downward toward the two river valleys, predominantly towards the South Platte River Valley. There is no consumption of groundwater or impact on the groundwater system as a result of the operation of the FSV ISFSI.

Refer to ISFSI SAR Section 2.4 (Reference E2.8-1) for a further description of the hydrology in the surrounding vicinity of the ISFSI facility.

E2.5 GEOLOGY AND SEISMOLOGY

E2.5.1 BASIC GEOLOGIC AND SEISMIC INFORMATION

The geologic structure of the general area in which the site is located is shown in ISFSI SAR Figure 2.5-1 (Reference E2.8-1). The area lies on the east flank of the Colorado Front Range which is a complexly faulted anticlinal arch and on which are superimposed numerous smaller folds and faults. The rocks of the core of the anticlinal arch are Precambrian crystallines, including gneisses, schists, and quartzites which have been intruded by granitic rocks that range in age from Precambrian to Tertiary. On the east flank of the arch are Paleozoic and Mesozoic sedimentary rocks.

The regional structure of this part of Colorado is characterized by sedimentary rocks dipping eastward into the Denver Basin. Along the mountain front the regional structural pattern is interrupted by relatively small, en echelon anticlines that plunge to the southeast. In addition to the fold axes, two groups of faults have been recognized. The most notable occurs along the mountain front and includes a series of faults extending in a generally northwest-southeast direction from the Precambrian into the Paleozoic-Mesozoic sediments. The second group of faults has been recognized primarily in coal mines, located generally east of Boulder, Colorado. These faults have a northeast-southwest orientation. Both groups of faults are relatively high angle faults.

The faults and the minor folds are related to the uplift of the Front Range which began in Late Cretaceous and continued into the Tertiary. The field examination and photo interpretation of the area surrounding the site location failed to indicate any evidence of recent movement along any of the known faults. Additional details of geology and seismology are contained in ISFSI SAR Section 2.5 (Reference E2.8-1).

E2.5.2 VIBRATORY GROUND MOTION

A seismological study for the site was performed to determine the design basis earthquake for the site and the ground motion spectra associated with them. A more detailed description of seismic history and characteristics is contained in ISFSI SAR Section 2.5 (Reference E2.8-1).

The ISFSI facility is located in an area which has not experienced any observed earthquake activity. The closest active area is approximately 25 miles south (northeast Denver). From seismic history, no significant earthquake ground motion is expected at the ISFSI during its lifetime.

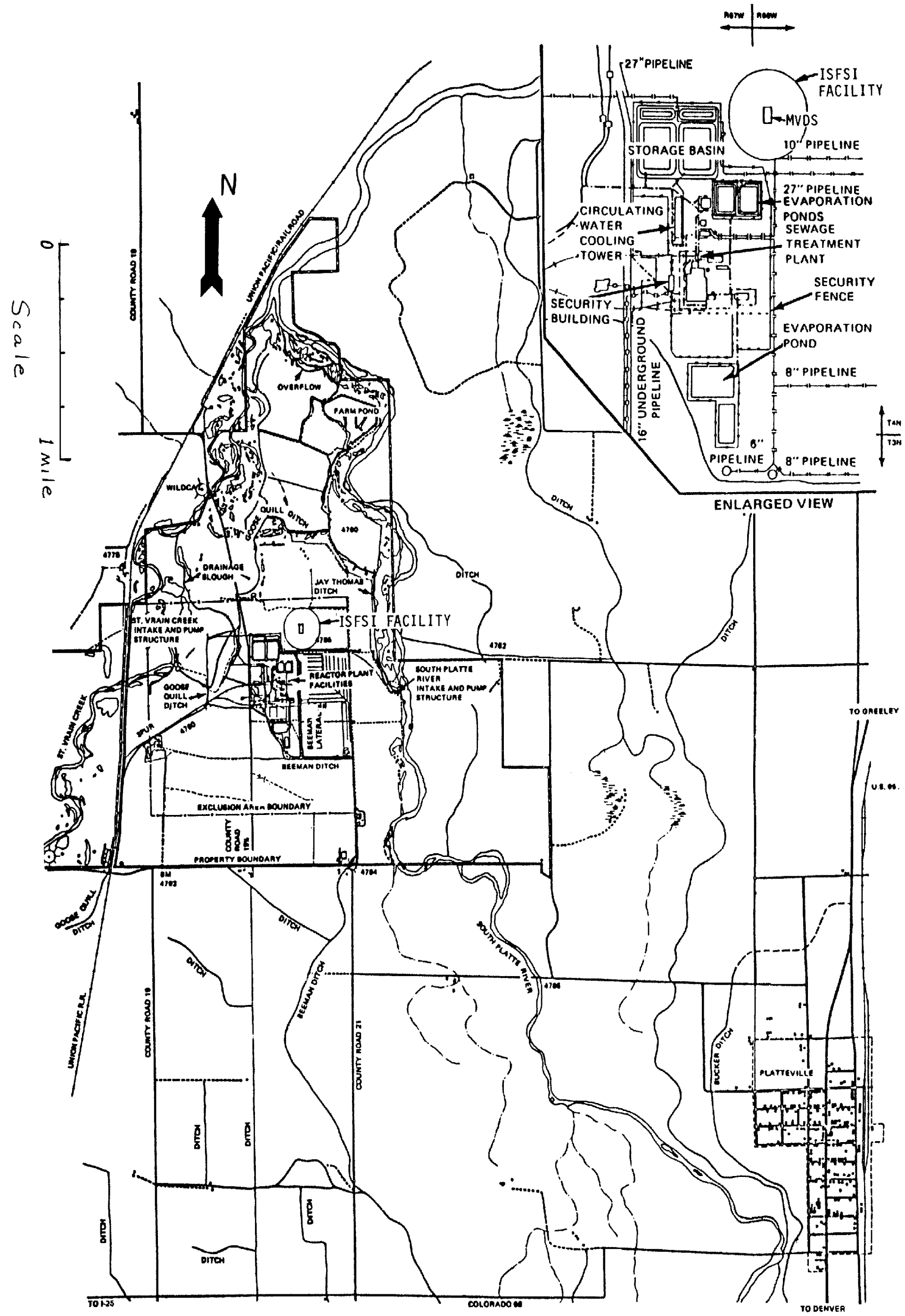

Figure E2-1. General Location of the ISFSI

E2.5.3 SURFACE FAULTING

As discussed previously in Section E2.5.1, the regional geology (east flank of the Front Range) is characterized by sedimentary rocks dipping eastward. Two groups of faults are most notable in the area along the mountain front. One group extends generally in a northwest-southeast direction and the other group in a northeast-southwest orientation. No known active faults exist at the ISFSI site.

A more detailed discussion on faulting is contained in ISFSI SAR Section 2.5 (Reference E2.8-1).

E2.5.4 STABILITY OF SUBSURFACE MATERIALS

A soil and foundation investigation at the ISFSI facility, performed and documented in 1990, is discussed in ISFSI SAR Section 2.5 (Reference E2.8-1). Test holes were drilled and samples retrieved. Laboratory testing was conducted to determine the static and dynamic engineering properties.

The subsoils at the ISFSI facility are St. Vrain-Platte River alluvial sands and gravel overlying Pierre claystone/shale bedrock. Generally up to 5 feet of loose slightly clayey sands overlay 4 to 7 feet of loose and medium dense clean to silty sands. Underneath this are medium dense to dense silty, and slightly silty sands and then very dense gravelly sands overlying the hard claystone shale bedrock at 47 to 49 feet. The claystone shale changes to very hard claystone/shale at 49 to 51 feet. Free water was measured in the test holes at the time of drilling at 16 and 19 feet.

Additional details of the subsoil stabilities are discussed in ISFSI SAR Section 2.5.4. (Reference E2.8-1).

E2.5.5 SLOPE STABILITY

The ISFSI facility topography is generally flat. The ground floor of the MVDS structure is situated slightly above the existing natural grade elevation. The bottom of the mat foundation is founded on the alluvium soil stratum below the natural ground surface.

A concrete apron surrounding the MVDS, with a gentle slope away, provides a suitable grade for adequate drainage. The concrete apron also provides protection of the immediate soils from erosion. Impact of flooding at the MVDS structure is discussed in ISFSI SAR Sections 2.4.3 and 3.2.2 (Reference E2.8-1).

E2.6 REGIONAL HISTORIC, ARCHAEOLOGICAL, ARCHITECTURAL, SCENIC, CULTURAL AND NATURAL FEATURES

The only significant archaeological site in the area is the Dent site about 4 1/2 miles northeast of the ISFSI on the South Platte River; it contains mammoth remains left by prehistoric Indians.

The original Fort St. Vrain was 2 1/2 miles northeast of the ISFSI and was one of several forts built at different times along the South Platte River. Fort Lupton is 10 miles southeast of the ISFSI; Fort Vasquez, which has been restored, is 4 miles southeast; and the remains of Fort Jackson are 8 miles southeast. Fort St. Vrain was abandoned in the 1840s, but its location is marked by a monument erected by the Colorado Historical Society. Fort Vasquez is listed in the National Register of Historic Places. The above information is contained in Reference E2.8-2.

In the Environmental Assessment documented for the FSV ISFSI (Reference E2.8-4), the NRC stated there would be no adverse impact on any historical, archeological, or cultural resources in the area from routine operations. In a recent permit application by PSCo (an Xcel Energy Company) to expand the generating capacity of the FSV Station (Reference E2.8-5), PSCo reported that consultation and coordination with the Colorado Historical Society's Office of Archeology and Historic Preservation indicated that while cultural sites are known to occur in the FSV Station vicinity along and near Saint Vrain Creek and the South Platte River, no sites were recorded in the facility expansion project area. The result was based on four previous surveys in the area. Since the FSV ISFSI is in the same location relative to the Saint Vrain Creek and the South Platte River, and 18 years of routine operations has had no adverse impact on any historical site in the region, it is reasonable to project there will be no adverse impact on any historical site in this region by the continued operation of the ISFSI at the described location. In consultation with the Colorado Historical Society's Office of Archeology and Historic Preservation, DOE-ID has requested concurrence from the Colorado State Historic Preservation Officer for compliance surety with Section 106 of the National Historic Preservation Act of 1966 (Reference E2.8-6).

E2.7 NOISE

Operation of the facility in the storage mode consists only of routine surveillance and maintenance and inspection activities of the systems, structures, and components (SSCs) important to safety. Continued operation will present negligible noise effects on the environment.

E2.8 REFERENCES

E2.8-1 Fort St. Vrain Independent Spent Fuel Storage Installation Safety Analysis Report.

E2.8-2 Final Environmental Statement Related to Operation of the Fort St. Vrain Nuclear Generating Station of Public Service Company of Colorado, Docket Number 50-267, U.S. Atomic Energy Commission, dated August, 1972.

E2.8-3 U.S. Census Bureau, Census 2000

E2.8-4 Environmental Assessment Related to the Construction and Operation of the Fort St. Vrain Independent Spent Fuel Storage Installation, USNRC Office of NMSS, Docket No. 72-9 (50-267), February 1991.

E2.8-5 Letter from John Lupo (PSCo) to Kim Ogle (Weld County), Installation of Two Simple-Cycle Natural Gas Turbine Generators (Units 5 and 6) at the Fort Saint Vrain Generating Facility, December 20, 2007.

E2.8-6 Letter from Mr. J. Hagers, DOE-ID, to Mr. E. C. Nichols, State Historic Preservation Officer, Colorado History Museum, Request for Consultation on the Extension of the Operating License for the Fort St. Vrain Independent Spent Fuel Storage Installation and Potential to Cause Effects on Historic Properties (EM-FMDP-09-081), October 26, 2009

E3.0 THE FACILITY

E3.1 EXTERNAL APPEARANCE

Figure 2.1-2 of Reference E3.10-1 shows the general location of the ISFSI facility. As shown in Figure 2.1-3 of Reference E3.10-1, the primary feature of the ISFSI facility is the MVDS located within a controlled area boundary that occupies less than 1.5 acres. Sections 1.2 and 1.3 of Reference E3.10-1 describe the external appearance of the ISFSI facility in more detail.

E3.1.1 MVDS SYSTEM

As described in Section 4.2 of Reference E3.10-1, the ISFSI facility contains the MVDS system which consists of a civil structure, fuel storage containers, equipment for handling the fuel storage containers and standby facilities.

The basic MVDS structure, as depicted in Figures 1.1-1, 1.1-2, and 1.1-3 of Reference E3.10-1, consists of vault modules, a transfer cask reception bay and a foundation structure. The basic structure is approximately 89 feet above ground elevation at its highest point and is approximately 135 feet long by 65 feet wide, using reinforced concrete and structural steel work as its principal building materials. The foundation structure is approximately 70 feet wide, 143 feet long and 4 feet thick and constructed of reinforced concrete. Section 4.2 of Reference E3.10-1 provides detailed specifications for the materials used.

E3.1.2 ADMINISTRATION BUILDING

An administration building is located on the west side of the MVDS. It consists of facilities to support ISFSI operations. There are no MVDS design or safety requirements associated with the administration building. Domestic water is supplied to the administration building from the Central Weld County Water District. A septic system and leach field are located west of the administration building such that any required maintenance may be performed without entering the protected area. This system is designed in accordance with Weld County requirements. The administration building is electrically heated and cooled to provide comfort for the occupants.

E3.1.3 EXTERNAL DESIGN

Landscaping around the ISFSI facility is confined to the appropriate grading to be compatible with the drainage pattern discussed in Section 2.1.2 of Reference E3.10-1.

E3.2 ELECTRIC SYSTEM

The electric system supporting the ISFSI facility has minimal environmental impact. The electrical services are only required to support the security system, administration building, fuel handling equipment during handling operations, instrumentation, heating and ventilation, and general building lighting. The normal power requirements are supplied from an existing 13 kV overhead distribution line located just southeast of the ISFSI facility. This line is fed from the Vasquez Substation. The ISFSI facility is fed via an underground feeder to a 220 KVA 13KV/480V pad-mounted transformer located at the ISFSI. Backup power is supplied by a battery in the Alarm Station hooked to an uninterrupted power supply.

E3.3 FACILITY WATER USE

The FSV ISFSI uses no water. The administration building does require the use of about 50,000 gallons of water per year for sewage disposal and personal hygiene. Water is supplied by the existing Weld County water distribution system.

E3.4 HEAT DISSIPATION SYSTEM

The MVDS system used at the ISFSI facility employs a totally passive design using an air flow cooling medium as described in Sections 3.3.2.2 and 4.2.3 of Reference E3.10-1. Based on the thermal analysis contained in Section 3.3.2.2 and Appendix A3-1 of Reference E3.10-1, this system does not create any significant plume at the discharge of the cooling air outlet chimney. Section E5.1 of this report evaluates the impact of this system on the environment.

E3.5 RADIOACTIVE WASTE SYSTEMS AND SOURCE TERMS

E3.5.1 SOURCE TERMS

Section 7.2.1 of Reference E3.10-1 characterizes the radiation sources used as a design basis for the ISFSI facility. Section 3.1.1 and Table 3.1-2 of Reference E3.10-1 provide a more detailed description of the spent fuel radiological characteristics. Sections 4.3 and 4.4 of Reference E3.10-1 discuss the provisions included in the design to preclude airborne releases during fuel transportation and storage. Section 7.3 of Reference E3.10-1 describes the overall radiation protection measures incorporated into the ISFSI design. Section 7.3.2 of Reference E3.10-1 specifically addresses the shielding analyses performed to assure the facility incorporates adequate shielding.

Section 7.6.4.1 of Reference E3.10-1 discusses tritium monitoring that has been instituted within the ISFSI as a means of monitoring the effects of facility aging during the prolonged storage period. The tritium monitoring is performed quarterly on the ISFSI charge face and annually in each of the six ISFSI chimneys. The charge face monitoring is intended to detect gross failures related to the FSC O-ring seals while the chimney monitoring is intended to detect failures related to the FSCs themselves.

E3.5.2 RADIOACTIVE WASTE SYSTEMS

Section 6.1 of Reference E3.10-1 outlines the total estimated quantities of radioactive liquid and solid waste to be generated. Per Section 6.1 of Reference E3.10-1, no gaseous radioactive wastes are expected to be generated. As described in Section 4.2.3.2 of Reference E3.10-1, the vault area contains a collection system that collects any potentially radioactive liquids. Liquid collected in this collection system is sampled on a quarterly basis and monitored to determine if it is radioactive or not prior to disposal. Samples collected-to-date have not indicated the presence of any radioactivity attributed to ISFSI operations. If the liquid is ever found to be radioactive, it will be handled as outlined in Section 6.1 of Reference E3.10-1.

E3.5.3 PROCESS AND EFFLUENT MONITORING

As described in more detail in Section 6 of this Environmental Report Supplement as well as Section 3.3.5 and 7 of Reference E3.10-1, no fixed radiation monitoring equipment is installed except thermoluminescent dosimetry required at the MVDS controlled area boundary.

E3.6 CHEMICAL AND BIOCIDE WASTES

The use of chemicals or biocides at the ISFSI facility is limited to detergents commonly used for building cleaning applications, herbicides for controlling weeds, and pesticides used for controlling pests. The only chemical waste listed in Table III-6 of the 10 CFR Part 50 FSV Final Environmental Statement (Reference E3.10-2) that is expected to be used is detergents. The other chemicals listed in Table III-6 have not been used to support operation of the ISFSI facility. Sections 3.3.8 and 5.1.2.2 of the Foster Wheeler Energy Applications (FWEA) MVDS Topical SAR (Reference E3.10-3) confirm that no other chemicals which could cause a hazard are involved in the MVDS storage process or are required for the MVDS to function. Sanitary wastes are not generated at the ISFSI, but are generated at the administration building discussed in Sections E3.1.2 and E12.1.1

E3.7 SANITARY AND OTHER WASTES

E3.7.1 SANITARY WASTES

Sanitary wastes are not generated at the ISFSI, but are generated at the administration building discussed in Sections E3.1.2 and E12.1.1.

E3.7.2 OTHER NONRADIOACTIVE WASTES

The ISFSI facility does not generate any other nonradioactive wastes. About 30 cubic feet of waste paper and office trash is generated at the administration building each week and disposed in the municipal land fill.

E3.7.3 GASEOUS EFFLUENTS

The only gaseous effluent at the ISFSI facility during normal operations is discharge from the Heat Dissipation System discussed in Sections E3.4.

E3.8 REPORTING OF RADIOACTIVE MATERIAL MOVEMENT

E3.8.1 SPENT FUEL MOVEMENTS

The handling of spent fuel and other radioactive materials associated with spent fuel storage at the FSV ISFSI facility takes place entirely on DOE owner controlled property. There currently are no off-site movements of spent fuel, therefore no reporting associated with spent fuel movements.

E3.8.2 OTHER RADIOACTIVE MATERIAL MOVEMENTS

No other radioactive material movements are currently anticipated.

E3.9 TRANSMISSION FACILITIES

As discussed in Section E3.2, the electrical power requirements are supplied from an existing distribution line. Section E5.5 of this report addresses the impact of operating and maintaining this 13 kV distribution line.

E3.10 REFERENCES

E3.10-1 Fort St. Vrain Independent Spent Fuel Storage Installation Safety Analysis Report.

E3.10-2 United States Atomic Energy Commission, Directorate of Licensing, “Final Environmental Statement Related to Operation of the Fort St. Vrain Nuclear Generating Station of Public Service Company of Colorado, Docket Number 50-267,” dated August, 1972.

E3.10-3 Foster Wheeler Energy Applications Modular Vault Dry Store Topical Safety Analysis Report.

E4.0 ENVIRONMENTAL EFFECTS OF SITE PREPARATION AND FACILITY CONSTRUCTION

The Environmental Report submitted by PSCo with the initial ISFSI license application discussed the environmental effects of ISFSI site preparation and facility construction including the effects on land use, water body use, impact of the work force, impact of construction generated fugitive dust, impact on wildlife, and construction noise. The environmental impacts during construction were negligible. There were no transmission facilities constructed to support the ISFSI facility. There were no major irreversible or irretrievable commitments of resources associated with the ISFSI construction. Construction workers received no occupational radiation exposure during construction of the ISFSI. Every reasonable mean to minimize and mitigate any environmental impacts were taken during construction of the ISFSI.

Discussion of the environmental effects of ISFSI site preparation and facility construction were deleted from the Environmental Report submitted by DOE with the ISFSI license transfer application.

Since this Environmental Report Supplement accompanies an ISFSI license renewal application, facility construction has long been completed, and in accordance with 10 CFR 51.60(a) for material licenses, the previous discussion on the environmental effects of ISFSI site preparation and facility construction is incorporated by reference. There has been no significant environmental change resulting from operational experience of the FSV ISFSI.

E5.0 ENVIRONMENTAL EFFECTS OF ISFSI OPERATION

E5.1 EFFECTS OF OPERATION OF HEAT DISSIPATION SYSTEM

The MVDS is a reinforced concrete structure covered by a clad steel framework. Six vault modules store spent fuel within the MVDS. There is a matrix of 45 fuel storage positions within each concrete vault module. Each fuel storage container can store six graphite fuel elements, six neutron source elements, or twelve reflector elements in a vertical position. The MVDS structure provides biological shielding as well as a passive heat removal system for the decay of the irradiated fuel elements.

The decay heat is removed from the exterior of the fuel storage containers to the outside air by natural draft convection. Air enters the lower part of the MVDS through the cooling air inlet structure, circulates around the fuel storage containers, and exits through the cooling air outlet chimney. The fuel is completely sealed in the fuel storage containers. As such, the impact of the cooling air on the environment is limited to the effects of the heat dissipation system which are minimal.

E5.2 RADIOLOGICAL IMPACT FROM ROUTINE OPERATION

E5.2.1 ANALYSIS OF ISFSI CONTRIBUTION

The graphite fuel elements contain the fuel rods which are composed of fuel kernels that have a TRISO ceramic coating which forms the primary containment barrier (refer to Section 3.3.2 of Reference E5.9-1). The fuel elements are stored in sealed metal fuel storage containers which forms the secondary containment barrier. This dual barrier isolates the radioactive material from the environment. The fuel storage containers are positioned in a concrete vault structure which has a minimum wall thickness of 3' 6". Thus, these barriers prevent any radioactive effluent from escaping from the MVDS during normal operation of the facility.

E5.2.2 RADIOACTIVITY IN THE ENVIRONMENT

An analysis of background radiation levels from the existing environment was performed to determine the additional contribution that the ISFSI makes to these background levels. The ISFSI radiation levels from natural and man-made sources was compared to the regulatory requirements of 10 CFR 72.104 (Reference E5.9-2) and 40 CFR 190 (Reference E5.9-3).

For members of the general public, it is assumed that the nearest continuously occupied residence will receive the maximum radiation exposure level from the MVDS. The nearest residence is located approximately 2,600 feet northwest of the MVDS. A MVDS loaded with six segments of spent fuel resulted in less than 5 mrem/yr to that location during the first year of fuel loading operations. Radiation exposure due to the FSV MVDS since the first year of operation has not exceeded the regulatory requirements of

25 mrem/yr in 10 CFR 72.104 and is expected to continue to be well below regulatory limits during the renewed license period. The annual dose to an individual beyond the controlled area boundary has been less than 0.15 mrem since 1993 as routinely reported in accordance with 10 CFR Part 72.44. Annual collective occupational radiation exposure at the FSV ISFSI, trended in accordance with Section 7.1.1 of Reference E5.10-1 and reported in quarterly performance metric reports, continues to be zero. For off-normal event scenarios, an operator dose of 80 mrem maximum is predicted during cleaning of a full or partial blockage of an air inlet to a vault module, as discussed in Section 8.0 of Reference E5.10-1.

E5.3 EFFECTS OF CHEMICAL AND BIOCIDE DISCHARGES

The activities associated with the FSV ISFSI do not involve the processing, cleaning, or otherwise changing the materials in storage under normal operation. At the ISFSI facility the only effluents of a chemical or biocide nature expected are water containing cleaning fluids (detergent) used to clean walls and floors in the facility and rainwater with dirt or dust that has been deposited on the buildings.

The spent fuel is stored in sealed fuel storage containers, therefore no effluents from the stored fuel would normally result. The environmental effects of accidents in which loss of fuel containment integrity is assumed are addressed in Section E7.0.

E5.4 EFFECTS OF SANITARY WASTE DISCHARGES

There are presently no sanitary waste discharges from the ISFSI facility. An administration building was built immediately west of the ISFSI. As described in Section E12.1.1, Weld County issued a Certificate of Occupancy which included a review of the septic/leach system (Reference E5.9-5).

E5.5 EFFECTS OF OPERATION AND MAINTENANCE OF THE ELECTRICAL DISTRIBUTION SYSTEMS

The power requirements for the ISFSI facility are supplied by a buried tap from an existing 13 kV distribution line. Operation and maintenance of buried distribution lines have historically resulted in minimal environmental effects.

E5.6 OTHER EFFECTS

E5.6.1 NOISE IMPACT

Operational noise associated with the ISFSI resulted from the transfer of fuel to the storage facility. Fuel transfers within the ISFSI during the renewed license period are not anticipated. The noise level experienced during transfer of spent fuel from the FSV HTGR to the ISFSI was less than a 24 hour time-weighted average of 80 dBA inside the

ISFSI, and less than ambient noise levels outside the facility attributed to neighboring power generation, agricultural, oil, and natural gas well operations.

E5.6.2 CLIMATOLOGICAL IMPACT

Continued operation of the ISFSI facility will not affect the climate of the region. The temperature range of the stored spent fuel elements and the cooling air exhausted from the MVDS (-32 °F to 120 °F by design) is greater than the ambient air temperature range (-17 °F to less than 120 °F). Precipitation does not vaporize at the MVDS because the MVDS temperature is only slightly higher than the ambient temperature. The creation or enhancement of fog formation beyond the controlled area boundary is negligible. Any fog that is formed in the vicinity of the modules carries no radioactive materials from the ISFSI facility. Continued operation of the MVDS is not expected to create any additional disturbance to wildlife in the area of the FSV ISFSI facility

E5.6.3 IMPACT ON WILDLIFE

Continued operation of the MVDS is not expected to create any additional disturbance to wildlife in the area of the FSV ISFSI facility. Subsequent to informal consultation in accordance with 50 CFR Part 402, the U.S. Fish and Wildlife Service concurs that continued operation of the FSV ISFSI is not likely to jeopardize the continued existence of any listed endangered or threatened species or result in adverse modification of critical habitat (Reference E5.10-10).

E5.6.4 IMPACT OF RUNOFF FROM OPERATION

The radioactive contamination under normal operating conditions is confined to the metal fuel storage containers and is not accessible to the external environment. Therefore, the precipitation runoff from the ISFSI does not contain any radioactive contamination and does not require holdup capability or special monitoring. Drainage of the runoff is discussed in Section E2.4.1.

E5.6.5 VEHICLE EMISSIONS DURING OPERATION

The effect on the environment resulting from vehicle emissions used for ISFSI facility operation is minimal since vehicles are not used for normal operations.

E5.7 RESOURCES COMMITTED

There is no irreversible and irretrievable commitment of resources associated with the ISFSI facility operation.

E5.8 DECOMMISSIONING AND DISMANTLING

The plan for decommissioning the ISFSI is fully detailed in the Decommissioning Plan (Reference E5.9-4) submitted to the NRC as part of the 10 CFR Part 72 license renewal application. At the time of decommissioning the ISFSI facility, only trace activity is expected in the empty fuel storage containers and container handling machine. The MVDS can be decontaminated and dismantled using commercially available techniques.

E5.9 CUMULATIVE IMPACTS

DOE-ID has examined the impacts to the environment that would result from the incremental impact from the proposed continued operation of the FSV ISFSI when added to the impacts from other past, present and reasonably foreseeable future actions in the vicinity of the ISFSI, consistent with the guidance in NUREG-1748 (Reference E5.10-7). As discussed in the preceding sections of this Environmental Report Supplement, the FSV ISFSI is an existing facility for which no new construction is contemplated, and the impacts from continued operation of the FSV ISFSI would remain substantially unchanged from the impacts of prior storage operations at the ISFSI.

Various industrial facilities, oil and gas infrastructure, and agricultural activities are located near the FSV ISFSI, including the FSV Station, several natural gas pipelines, light industrial facilities in the City of Platteville, and new oil and gas infrastructure (attributed to expansion of the FSV Station generating capacity) as discussed in Chapters 2 and 3 of the Safety Analysis Report (Reference E5.10-1). The prior NRC Environmental Assessment (Reference E5.10-6) considered the cumulative impacts from facilities and activities in the vicinity of the FSV ISFSI at that time, and concluded that the then-present and reasonably foreseeable future actions of the neighboring oil and gas industry installations, as well as the diversity of their respective operations, would not have potentially significant cumulative impacts.

More recently, the expansion of the FSV Station, with two new gas turbine generators and a new natural gas line, was addressed by the Weld County Board of Commissioners, which concluded that the natural and socio-economic environment would be protected based on a review of land use, water, air, nose, wildlife, vegetation, community services, community infrastructure, cultural resources and other impacts (Reference E5.10-8). There has been some public concern with respect to the air permit for the FSV Station and air emissions of nitrogen oxides, carbon monoxide, particulate matter, volatile organic compounds and other non-radioactive pollutants from the FSV Station (Reference E5.10-9). However, as discussed previously in this Environmental Report Supplement, continued operation of the FSV ISFSI would not release such pollutants and thus would not contribute to such cumulative impacts. Therefore, continued operation of the FSV ISFSI would not result in significant cumulative impacts when added to the impacts from other past, present and reasonably foreseeable future actions in the vicinity of the ISFSI.

E5.10 REFERENCES

E5.10-1 Fort St. Vrain Independent Spent Fuel Storage Installation Safety Analysis Report

E5.10-2 10 CFR 72, "Licensing Requirements for the Independent Storage of Spent Nuclear Fuel and High-Level Radioactive Waste"

E5.10-3 40 CFR 190, "Environmental Radiation Protection Standards for Nuclear Power Operations"

E5.10-4 Fort St. Vrain Independent Spent Fuel Storage Installation Decommissioning Plan

E5.10-5 Certificate of Occupancy, Weld County, Colorado, August 5, 1997

E5.10-6 Environmental Assessment Related to the Construction and Operation of the Fort St. Vrain Independent Spent Fuel Storage Installation, USNRC Office of NMSS, Docket No. 72-9 (50-267), February 1991

E5.10-7 Environmental Review Guidance for Licensing Actions Associated with NMSS Programs (NUREG-1748), August 2003

E5.10-8 Weld County Resolution, Re: Approve Site Specific Development Plan and Use by Special Review Permit No. 1647 and A 1041 Permit for a Major Facility of a Public Utility (Fort Saint Vrain Generating Facility and Associated Natural Gas Pipeline) in the I-3 (Industrial) and A (Agricultural) Zone Districts – Public Service Company of Colorado, March 5, 2008 (available at www.co.weld.co.us/meetings-minutes/ResolutionsPast/Resolutions2008/Reso%200821.html)

E5.10-9 Federal Register, Volume 72, No. 54, Page 13277, Clean Air Act Operating Permit Program; Petition for Objection to State Operating Permit for Public Service Company, Fort Saint Vrain Station, March 21, 2007

E5.10-10 Letter from Mr. J. Hagers, DOE-ID, to Ms. S. Linner, Colorado Field Office, U.S. Fish and Wildlife Service, Request for Concurrence on Determination that Extension of the Operating License for the Fort St. Vrain Independent Spent Fuel Storage Installation Will Not Likely Adversely Affect Endangered or Threatened Species and Critical Habitat (EM-FMDP-09-071), October 13, 2009 [Concurrence received October 20, 2009]

E6.0 EFFLUENT AND ENVIRONMENTAL MEASUREMENTS AND MONITORING PROGRAM

E6.1 PRE-OPERATIONAL ENVIRONMENTAL PROGRAM

E6.1.1 FSV REACTOR PRE-OPERATIONAL ENVIRONMENTAL PROGRAM

In July 1967, Colorado State University (CSU), under the direction of PSCo, performed a one-year long radiological study at the FSV Nuclear Generating Station. The results of this study provided the basis for establishing the Environmental Radiation Surveillance Program for FSV.

Sample collection for the pre-operational phase of this monitoring program began in March 1969, primarily using air monitors. The balance of the sample collection program was added in the third quarter of 1969. The pre-operational phase of this monitoring program was intended to permit the construction of a statistical baseline of radionuclide activity levels associated with the different sample media for those radionuclides of concern. The pre-operational phase ended in January 1974 when the FSV reactor attained initial criticality.

The FSV reactor operating license was issued in December 1973. The 10 CFR 50 Technical Specifications then became the controlling document governing the FSV Environmental Radiation Surveillance Program.

E6.1.2 ISFSI PRE-OPERATIONAL ENVIRONMENTAL PROGRAM

In addition to the data available from the description in Section E6.1.1, CSU performed a pre-operational site radiological characterization study for the ISFSI location. This study involved:

- The placement of thermoluminescent dosimeters (TLDs) at the ISFSI location.
- The placement of TLDs along the spent fuel transport route between the Reactor Building and the MVDS.
- Continuous air monitoring for air concentrations of fission products, actinide products, and tritium at the ISFSI location.
- Taking surface and core soil samples at the ISFSI location and along the spent fuel transport route. The soil samples were analyzed by gamma spectroscopy.

The TLDs were identical to the type used in the FSV Radiological Environmental Monitoring Program (previously the Environmental Radiation Surveillance Program). CSU determined and compensated for contributing exposure rates from other stored radioactive waste materials and effluents. The duration of the ISFSI location radiological characterization study was approximately six months, excluding time to compile the data and issue a final report completely characterizing the ISFSI location background.

The ISFSI was not expected to adversely affect any surrounding surface waters or ground waters. Therefore, sampling of surface and ground waters was not performed as part of the pre-operational environmental monitoring program.

E6.2 OPERATIONAL MONITORING PROGRAMS

E6.2.1 ISFSI OPERATIONAL MONITORING PROGRAM

The ISFSI Radiological Environmental Monitoring Program is conducted to provide data on levels of radiation and radioactive material in the site environs. The program discriminates between those changes in environmental radiation and radioactivity levels resulting from radioactive releases from the ISFSI and those changes attributed to other sources, such as radioactive fallout. The program evaluates the relationship between quantities of radioactive material released in liquid and gaseous effluents, and resultant radiation doses to individuals from principal pathways of exposure. The results of this program, summarized in annual reports published in accordance with 10 CFR 72.44 (Reference E6.5-3), are used to verify the effectiveness of in-facility measures applied to control the release of radioactive materials. The monitoring program results continue to support the conclusion reached in the Safety Analysis Report that operation of the facility will not result in a significant dose commitment greater than 0.15 mrem/y to the nearest resident, and the dose rate at the controlled area boundary has not been distinguishable from the ambient background dose rate which is about 0.4 mR/d.

E6.3 RELATED ENVIRONMENTAL MEASUREMENT AND MONITORING PROGRAMS

The ISFSI facility does not lie within a region for which environmental measurement or monitoring programs are carried out by public agencies or other agencies directly supported by DOE.

E6.4 PRE-OPERATIONAL ENVIRONMENTAL RADIOLOGICAL MONITORING DATA

Data from the ISFSI pre-operational environmental program (Reference E6.5-3), as described in Section E6.1.2, was available for NRC review prior to construction of the ISFSI. Annual radiological environmental monitoring reports have been transmitted to the NRC since fuel loading at the FSV ISFSI was completed June 1992 in accordance with 10 CFR 72.44.

E6.5 REFERENCES

E6.5-1 Fort St. Vrain High Temperature Gas Cooled Reactor Technical Specifications

E6.5-2 Fort St. Vrain Independent Spent Fuel Storage Installation Safety Analysis Report

E6.5-3 Fort St. Vrain Independent Spent Fuel Storage Installation Annual Radiological Environmental Monitoring Reports

E7.0 ENVIRONMENTAL EFFECTS OF ACCIDENTS

E7.1 FACILITY ACCIDENTS INVOLVING RADIOACTIVITY

The FSV ISFSI postulated accidents are addressed in Section 8 of Reference E7.5-1 which discusses the spectrum of accidents analyzed and identifies accidents involving radioactivity exposure.

E7.1.1 NORMAL OPERATIONS AND OPERATIONAL OCCURRENCES

Section E5.2 of this report addresses the radiological impact from routine operation. Section 8.1 of Reference E7.5-1, outlines the postulated off-normal event scenarios resulting from operational occurrences. As summarized in ISFSI SAR Table 8.1-1 and SAR Section 8.1 (Reference E7.5-1), these postulated scenarios result in offsite annual doses of less than or equal to 25 mrem. As discussed in Section 8.0 of Reference E7.5-1, the dose criteria for workers in 10 CFR Part 20 would not be exceeded for the off-normal event scenarios, with an operator dose of 80 mrem maximum predicted during cleaning of a full or partial blockage of an air inlet to a vault module. Therefore, the postulated exposures discussed in these references are within the 10 CFR 72.104 and 10 CFR part 20 guidelines.

E7.1.2 MAXIMUM CREDIBLE ACCIDENT

The maximum credible accident discussed in ISFSI SAR Section 8.2.15 and Appendix A8-9 (Reference E7.5-1), represents the worst case postulated scenario. This accident results from the leak of one FSC in a vault module. The release is through the MVDS stack. This accident could be caused by two postulated failures, failure of the redundant metal O-ring seals or failure of the FSC due to corrosion. This accident results in a calculated maximum exposure of 1 mrem whole body at the controlled area boundary. Refer to Table 1 in Appendix A8-9 for maximum calculated exposures to organs. These calculated exposures are within the 10 CFR 72.106 requirements.

E7.1.3 EMERGENCY PLANNING

The provisions for emergency planning as they are applicable to the ISFSI facility are discussed in Reference E7.5-2 and ISFSI SAR Section 9.5 (Reference E7.5-1).

E7.2 TRANSPORTATION ACCIDENTS INVOLVING RADIOACTIVITY

As described in ISFSI SAR Section 4.3, (Reference E7.5-1), the handling operations involving spent fuel take place totally within the FSV site boundary. Since there is currently no further offsite transport of spent fuel from the ISFSI facility, accident analyses for offsite transport are not required. An analysis per 10 CFR 71 will be conducted at the time of any transport using shipping casks that have been procured and for which there are Certificates of Compliance. The TN-FSV casks, which have received a Certificate of Compliance are available for performing offsite transport of the spent fuel contained in the FSV ISFSI (Reference E7.5-3).

E7.3 OTHER ACCIDENTS

ISFSI SAR Sections 2.2 and 3.3.6 (Reference E7.5-1) address the potential of fire, explosion and aircraft hazards to the ISFSI facility. Based on the analyses outlined in the referenced sections, the results of these potential hazards are either bounded by other accident scenarios or the probability of their occurrence is sufficiently low that they are excluded from being considered in the design bases.

E7.4 INTENTIONAL DESTRUCTIVE ACTS [5]

The Department of Energy Idaho Operations Office (DOE-ID) provides substantial safeguards and security measures for the Fort St. Vrain (FSV) Independent Spent Fuel Storage Installation (ISFSI) required by the Nuclear Regulatory Commission (NRC) pursuant to the license for the FSV ISFSI. These measures are designed to prevent theft or diversion of spent fuel and radioactive materials in the ISFSI, and to prevent exposure of workers and the public to radiation from the spent fuel and radioactive materials, both during normal operations and during accidents.

After the terrorist events of September 11, 2001 (9/11), DOE-ID considered and implemented, and continues to implement, various measures to minimize the likelihood and consequences of a potential terrorist attack on the FSV ISFSI or materials stored in it, pursuant to direction from NRC. In December 2001, a conference call was held between NRC Region IV and DOE-ID to discuss the security posture of the FSV ISFSI. Security enhancements and commitments made as a result of the conference call were documented in a letter from DOE-ID to the NRC Region IV (Reference E7.5-1).

In October 2002, the NRC issued to DOE-ID an Order for Interim Safeguards and Security Compensatory Measures (Reference E7.5-2) that modified the specific license for the FSV ISFSI to require compliance with specified interim safeguards and security compensatory measures above and beyond those additional security measures implemented following the events of September 11, 2001. The specified interim safeguards and security compensatory measures, based on a terrorist threat scenario,

[5] The ensuing discussion is provided for additional information. It is not necessarily the approach followed in other environmental reports for other license applications, and should not be construed as setting any precedent here or in other contexts. In this regard, prior Nuclear Regulatory Commission (NRC) decisions hold that the National Environmental Policy Act (NEPA) does not require that the NRC consider the environmental consequences of hypothetical terrorist attacks on NRC-licensed facilities, particularly for facilities located outside of the geographic range of the Ninth Circuit and outside of the geographic area where Ninth Circuit precedent is binding. Moreover, while the Ninth Circuit Court of Appeals has held that NEPA requires an analysis of potential environmental impacts from hypothetical terrorist attacks, at least one other circuit court has declined to so hold.

were implemented by April 2003 to further reduce the likelihood of a successful terrorist attack on the ISFSI by establishing a substantial deterrent to an attack, providing reasonable assurance that an attempted attack could be detected and effectively resisted, and mitigating the extent of damage and the radiological consequences if an attack were to occur.

In November 2003, the NRC conducted a security inspection of the FSV ISFSI (Reference E7.5-3). Inspectors found the safeguards and security measures to be effectively implemented and in compliance with the Physical Protection Plan and Order.

The Physical Protection Plan for the FSV ISFSI (Reference E7.5-4) documents the provision of physical protection in accordance with 10 CFR 72.180 and 10 CFR 73.51, to protect, among other things, against any loss of control of the facility that could be sufficient to cause radiation exposure exceeding dose equivalent limits specified in 10 CFR 72.106. Appendix A of the Physical Protection Plan documents the pre-9/11 threat analysis and design for physical protection. The ISFSI design features and post-9/11 security measures in place further reduce the likelihood of a successful terrorist attack, and provide reasonable assurance that the spent fuel stored in the ISFSI is adequately protected. As demonstrated by the above measures (including communication, on-site security force, off-site response, vehicle search, personnel and vehicle access control), a successful terrorist attack on the FSV ISFSI is unlikely.

With respect to the potential consequences of an unlikely intentional destructive act, the interim safeguards and security compensatory measures pursuant to NRC Order (Reference E7.5-2) included documented analysis of a hypothetical terrorist threat scenario at the FSV ISFSI. This post-9/11 analysis demonstrates that the location of the vehicle barrier system (VBS) is such that an explosion at the VBS would not prevent protective features of the Modular Vault Dry Store (MVDS) from isolating the vaults and ensuring that convective cooling of the fuel is not interrupted. Surviving equipment and structures will continue to protect the stored spent nuclear fuel.[6]

In addition, Sections 3.36 and 8.2.4 of the SAR (Reference E7.5-1) address the potential impacts of various postulated accidents and hazards, including internal fires and external (off-site) explosions form small aircraft (such as crop dusters), oil/gas wells, pipelines, a larger storage tank, and diesel fuel tanks.[7] For all such postulated scenarios, the MVDS concrete structure and important-to-safety equipment would continue to carry out their safety functions, maintain the FSCs in a subcritical array,

[6] DOE-ID believes that this condition would compare qualitatively with the MVDS condition following a Design Basis Tornado event analyzed and documented in the SAR, Chapter 8 (Reference E7.5-1).
[7] As summarized in section E.7.3 of this Environmental Report Supplement, “[The] ISFSI SAR…address[es] the potential fire, explosion and aircraft hazards to the ISFSI facility. Based on analysis outlined in the referenced sections [of the SAR], the results of these potential hazards are either bounded by other accident scenarios or the probability of their occurrence is sufficiently low that they are excluded from being considered in the design bases.”

provide adequate radiation shielding, and not compromise nuclear safety of the FSV ISFSI.

Therefore, based on the above post-9/11 analysis and analyses documented in the SAR, DOE-ID expects that an unlikely terrorist attack at or near the FSV ISFSI would not result in a radiological release to the environment, the workers or the public.[8]

E7.5 REFERENCES

E7.5-1 Fort St. Vrain Independent Spent Fuel Storage Installation Safety Analysis Report

E7.5-2 Fort St. Vrain Independent Spent Fuel Storage Installation Emergency Response Plan

E7.5-3 Certificate of Compliance No. 9253, Revision 12, Package Certification No. USA/9253/B(U)F-85

E7.5-4 Letter from M. W. Frei (DOE-ID) to D. D. Chamberlain (NRC Region IV), Security Enhancements for the Fort St. Vrain Independent Spent Fuel Storage Installation, INTEC-NRC-01-072, December 21, 2001 (controlled Safeguards Information)

E7.5-5 Letter from M. J. Virgilio (NRC) to W. Bergholz (DOE-ID), Issuance of Order for Interim Safeguards and Security Compensatory Measures for Department of Energy, October 16, 2002 (controlled Safeguards Information)

E7.5-6 Letter from T. W. Pruett (NRC) to E. D. Sellers (DOE-ID), NRC Inspection Report 07200009/2003001 Fort St. Vrain Independent Spent Fuel Storage Installation, January 29, 2004

E7.5-7 Physical Protection Plan for the Fort St. Vrain Independent Spent Fuel Storage Installation, Revision 7, October 8, 2007 (controlled Safeguards Information)

[8] The above assumes that the consequences (structural damage to the FSV ISFSI and radiation exposure) would be no greater than a Design Basis Tornado event, analyzed and documented in the SAR, Chapter 8 (Reference E7.5-1). Although low-level waste is not currently or routinely stored at the FSV ISFSI, a breach of a drum of low-level waste at the ISFSI could result in a whole body dose of 48 mrem to an individual located within 20 feet of a low-level waste drum blown out of the ISFSI, and a dose of less than 1 mrem to the whole body and to the lungs (maximum exposed organ) to an individual located 100 meters from the ISFSI as discussed in Chapter 8 of the SAR (Reference E7.5-1), if low-level waste were to be stored at the ISFSI and assuming that the consequences of a terrorist attack at or near the FSV ISFSI approximated the consequences of a tornado striking the ISFSI (tornado driven missile).

E8.0 ECONOMIC AND SOCIAL EFFECTS OF ISFSI OPERATION AND ENVIRONMENTAL JUSTICE CONSIDERATIONS

E8.1 ECONOMIC AND SOCIAL EFFECTS OF ISFSI OPERATION

The FSV ISFSI work force continues to involve up to sixteen DOE and contract employees associated with ISFSI related operations. The small number of local residents employed for this project has had no significant effect on the community.

E8.2 ENVIRONMENTAL JUSTICE CONSIDERATIONS

Executive Order 12898 ”Federal Actions to Address Environmental Justice in Minority and Low-Income Populations”, signed in February 1994, directs all Federal agencies to develop strategies for considering environmental justice. Environmental justice is described in the Executive Order as “identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations.” In Appendix C of NUREG-1748 (Reference 8.3-1) NRC has included draft interim guidance on environmental justice considerations for environmental reports and NRC analysis pursuant to the National Environmental Policy Act.

As discussed in subsection E2.1.2 of this Environmental Report Supplement, the 2000 Census information indicates that the minority population (and corresponding percentage of total population) within Weld County is 180,936 (27%) Hispanic or Latino, 1,022 (0.6%) Black or African American, 1,581 (0.9%) American Indian and Alaska Native, 1,508 (0.8%) Asian, and 150 (0.1%) Native Hawaiian and Other Pacific Islander. The minority distribution within a 4-mile radius (50 square miles) of the FSV ISFSI is assumed to be the same. The census information also indicates that the low-income population in Weld County in 1999 was 22,019, or 12.5% of the population. The low-income population distribution within a 4-mile radius (50 square miles) of the FSV ISFSI is assumed to be the same.

As discussed in the preceding sections of the Environmental Report Supplement, the impacts to the public and the environment from renewal of the FSV ISFSI specific license and continued operation of the ISFSI are not expected to differ substantially from the impacts from prior storage operations. In this regard, the radiological dose to an individual at the controlled area boundary following loading of the spent fuel into the ISFSI has not been distinguishable from the ambient background radiation, as discussed in subsection E5.2.2 of this Environmental Report Supplement. The impacts from the maximum credible accident (discussed in subsection E7.1.2), resulting from the leak of one FSC in a vault module, results in a calculated maximum exposure of 1 mrem whole body at the controlled area boundary, well within the 10 CFR 72.106 requirements. There are no potentially significant cumulative operational impacts on resources as discussed in subsection E5.9. Accordingly, the impacts from continued operation of the FSV ISFSI are not expected to be high and adverse.

Based on the forgoing, DOE-ID concludes that continued operation of the FSV ISFSI would not have disproportionately high and adverse effects on minority and low-income populations.

E8.3 REFERENCES

E8.3-1 Environmental Review Guidance for Licensing Actions Associated with NMSS Programs (NUREG-1748), August 2003.

E9.0 ALTERNATIVES

E9.1 PROPOSED ACTION

The proposed action is to renew the FSV ISFSI specific license for 20 years. The environmental impacts from storage of spent fuel in the FSV ISFSI would continue during the license renewal term under the proposed action, as discussed in the preceding sections of this Environmental Report Supplement.

E9.2 NO ACTION ALTERNATIVE

Under the "No Action" alternative, NRC would not renew the FSV ISFSI specific license. The current ISFSI license would expire in November 2011, and DOE-ID would not be able to store spent fuel at the FSV ISFSI after that time.

Under the "No Action" alternative, the impacts of decommissioning of the FSV ISFSI would be as discussed in section E5.8 of this Environmental Report Supplement, but would occur at an earlier date. NRC has prepared a generic environmental impact statement on decommissioning of nuclear facilities, including ISFSIs (Reference E9.4-1). NRC evaluated ISFSI decommissioning alternatives, radiation safety, cost, waste, and socioeconomic effects. NRC identified no prohibitory technical or environmental issues.

Decommissioning activities and their impacts are not distinguishable between the proposed action and the "No Action" alternative, because the "No Action" alternative, like the proposed action (and all other alternatives) would involve eventual decommissioning of the FSV ISFSI. DOE-ID would need to eventually decommission the FSV ISFSI regardless of the NRC decision on license renewal; license renewal would merely postpone decommissioning. Therefore, DOE-ID concludes that the "No Action" alternative does not provide any environmental advantages over license renewal.

E9.3 SPENT FUEL STORAGE ALTERNATIVES CONSIDERED IN ORIGINAL ENVIRONMENTAL REPORT

The Environmental Report submitted by PSCo with the initial ISFSI license application discussed spent fuel storage alternatives including long-term storage of spent fuel in the existing Fuel Storage Wells located at the FSV HTGR building, storage of six segments of spent fuel in Idaho, storage of spent fuel at other commercial sites, and interim storage of spent fuel at a monitored retrievable storage installation. Since none of the alternatives were deemed viable at the time, PSCo elected to design, license and construct an ISFSI adjacent to its reactor site in accordance with 10 CFR 72.

Discussion of the spent fuel storage alternatives was deleted from the Environmental Report submitted by DOE with the ISFSI license transfer application.

Two spent fuel storage alternatives to renewal of the current ISFSI license have been considered, both of which were investigated by PSCo and would include termination of the current license: storage of the spent fuel in Idaho, and storage of spent fuel at either other commercial sites or a monitored retrievable storage installation. Neither of the two alternatives are viable for the same reasons reported early by PSCo; PSCo's rational and analysis are hereby incorporated by reference in accordance with 10 CFR 51.60(a) for material licenses.

E9.4 REFERENCES

E9.4-1 NRC Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities (NUREG-0586), August 1988.

E10.0 FACILITY DESIGN ALTERNATIVES

The Environmental Report submitted by PSCo with the initial ISFSI license application discussed facility design alternatives. Discussion of the facility design alternatives was deleted from the Environmental Report submitted by DOE with the ISFSI license transfer application.

Since this Environmental Report Supplement accompanies an ISFSI license renewal application without design modifications, any further discussion of facility design alternatives is not warranted. The previous discussion on the facility design alternatives is incorporated by reference in accordance with 10 CFR 51.60(a) for material licenses. There has been no significant environmental change resulting from operational experience of the FSV ISFSI.

E11.0 SUMMARY COST-BENEFIT ANALYSIS, MITIGATION AND OTHER CONSIDERATIONS

E11.1 SUMMARY COST-BENEFIT ANALYSIS

The Environmental Report submitted by PSCo with the initial ISFSI license application presented a summary cost-benefit analysis. Presentation of a summary cost-benefit analysis was deleted from the Environmental Report submitted by DOE with the ISFSI license transfer application. Since many of the same benefits presented by PSCo remain valid for an ISFSI license renewal, and since this Environmental Report Supplement accompanies an ISFSI license renewal application, the previous summary cost-benefit analysis is incorporated by reference in accordance with 10 CFR 51.60(a) for material licenses. There has been no significant environmental change resulting from operational experience of the FSV ISFSI.

E11.2 MITIGATION

There are no impacts of license renewal that would require mitigation. Current operations include monitoring activities that will continue during the term of the license renewal period. DOE-ID performs routine monitoring activities to ensure the safety of workers, the public and the environment. These monitoring activities include the ISFSI Radiological Environmental Monitoring Program, which evaluates radioactive releases and the resultant radiation doses in published annual reports, as discussed in section E.6.2 of this Environmental Report Supplement.

E11.3 UNAVOIDABLE ADVERSE IMPACTS

Renewal of the FSV ISFSI specific license would not result in additional unavoidable adverse impacts from normal operations, as discussed in section E.5 of this Environmental Report Supplement. As discussed in subsection E7.1.1, the postulated off-normal events from operational occurrences would result in no offsite radiological consequences (measurable exposure), and the maximum worker dose would be 80 mrem. The maximum credible accident, a leak of one FSC in a vault module, would result in a calculated maximum exposure of 1 mrem whole body at the controlled area boundary, as discussed in subsection E7.1.2.

E11.4 SHORT TERM USE VERSES LONG TERM PRODUCTIVITY

The FSV ISFSI was designed as an interim storage facility. Once the ISFSI is decommissioned, the facility could be removed and the land could be used for another purpose.

E12.0 ENVIRONMENTAL APPROVALS AND CONSULTATION

E12.1 PERMITS AND LICENSES

In addition to approval from the NRC, the permits, licenses, or notices listed below are required for the FSV ISFSI facility. Water quality certification per Reference E12.3-1 and discharge permits per Reference E12.3-2 are not applicable to the facility, as discussed in Section E3.0.

E12.1.1 LOCAL AND COUNTY

After the administration building was constructed in 1999, Weld County issued a Certificate of Occupancy which included a review of the septic/leach system (Reference E12.3-3).

E12.1.2 STATE OF COLORADO

There are no permits required from the State of Colorado.

E12.2 CONSULTATIONS

In addition to the above agencies, the following agencies will be consulted during the continued operation of the FSV ISFSI.

E12.2.1 STATE OF COLORADO

The Colorado Department of Public Health and Environment will be consulted for any special permits that may be required by the state

E12.2.2 FEDERAL GOVERNMENT

The U.S. Nuclear Regulatory Commission and the Department of Energy will be the only federal agencies directly contacted during continued routine operation.

E12.3 REFERENCES

E12.3-1 Federal Water Pollution Control Act, Section 401.

E12.3-2 Federal Water Pollution Control Act, Section 402.

E12.3-3 Certificate of Occupancy, Weld County, Colorado, August 5, 1997

APPENDIX F

ADDITIONAL INFORMATION

APPENDIX F: ADDITIONAL INFORMATION

F1.0 TRAINING AND QUALIFICATIONS (10 CFR 72.28)

The FSV ISFSI SAR, Chapter 9 provides the information required by 10 CFR 72.28. Pursuant to 10 CFR 72.28(a) and (c), and as further discussed in the following paragraphs, Section 9.1 of the FSV ISFSI SAR discusses the organization and technical qualifications of the DOE-ID and its contractor staff to operate and maintain the ISFSI. Pursuant to 10 CFR 72.28(b), Section 9.3 of the FSV ISFSI SAR discusses the DOE-ID and contractor training program. The objective of the training program is to use a systematic approach for training and providing competent personnel to perform all activities related to the operation and maintenance of the FSV ISFSI. Pursuant to 10 CFR 72.28(d), DOE-ID commits to provide an adequate complement of trained and certified personnel possessing the required skills throughout the duration of the NRC license. This commitment includes providing the resources necessary for the contractor to maintain an adequate complement of trained and qualified operations personnel.

F1.1 TECHNICAL QUALIFICATIONS

DOE and its contractor personnel currently manage all the INL SNF (other than that managed by the Navy at the Naval Reactors Facility on the INL), including management of another NRC-licensed ISFSI. Through managing and operating the INL, DOE-ID and its contractors have acquired a broad range of technical capabilities that are applied to the FSV ISFSI. This experience includes:

- performing safety analyses for nuclear activities, environmental activities, and waste management operations;
- performing the function of DOE lead laboratory for the Office of Nuclear Energy;
- conducting environmental assessments and remediation of hazardous waste, mixed waste, and radioactive contaminated waste;
- performing environmental risk assessments and evaluating safety and risk for complex technical systems;
- implementing radiological control programs;
- designing, fabricating, and testing specialized facilities, prototype systems, components, software, hardware, instruments, and test equipment;
- handling heavy loads and developing remote handling and process automation capabilities through an extensive robotics program directed toward waste handling, accessing confined and hazardous areas, and performing repetitive skills;
- developing a decontamination and decommissioning program that is recognized as a national leader; and,

- characterizing and treating waste generated by the INL and other sites, including disposing of INL low-level waste, processing high-level waste, and storing and certifying transuranic waste.

In addition to these technical capabilities, the training program, along with other management systems, ensures that qualified individuals will be available to perform planned and unplanned tasks. This experience and training will ensure that DOE-ID has the available personnel resources to continue to operate, maintain, and decommission the FSV ISFSI in a manner that provides adequate protection to the health and safety of the worker, the public, and the environment.

F1.2 PERSONNEL TRAINING

A discussion of operator training was submitted with the license transfer application for the FSV ISFSI. Additionally, discussion of the training programs is provided in Section 9.3 of the FSV ISFSI SAR. The FSV ISFSI SAR is updated in accordance with regulatory requirements.

F1.3 OPERATING ORGANIZATION

A discussion of the operating organization was submitted with the license transfer application for the FSV ISFSI. Additionally, discussion of the operator organization is provided in Section 9.1 of the FSV ISFSI SAR. The FSV ISFSI SAR is updated in accordance with regulatory requirements.

F2.0 FINANCIAL ASSURANCE FOR DECOMMISSIONING (10 CFR 72.30)

A Decommissioning Plan was submitted with the license transfer application. A revised Decommissioning Plan reflecting new regulatory requirements is submitted with the license renewal application. Although the basic elements of the plan remain unchanged, the actual activities at the time of decommissioning will be dependent upon the regulations and practices in effect at that time. Discussion of decommissioning of the ISFSI is contained in Sections 3.5 and 9.6 of the FSV ISFSI SAR, which is periodically updated in accordance with regulatory requirements.

DOE is responsible for requesting, through the budget process, the necessary funds to decommission the FSV ISFSI. The costs (in 2008 dollars) for the selected decommissioning alternative have been estimated at approximately $2.4 million for radiological decommissioning activities. The cost estimate is based on Regulatory Guide 1.86, "Termination of Operating Licenses for Nuclear Reactors," dated June 1974. DOE believes that utilization of this guidance provides a conservative basis for the planning and cost estimate for eventual decommissioning of the ISFSI. DOE will request the necessary funding from Congress for the decommissioning of the ISFSI at the proper time.

F3.0 EMERGENCY PLANNING (10 CFR 72.32)

A description of emergency planning was submitted with the license transfer application for the FSV ISFSI. Emergency Plan changes are made and submitted to the NRC in accordance with 10 CFR 72.44(f). The most recent changes to the FSV ISFSI Emergency Plan were submitted in to the NRC on May 13, 2009. The Emergency Plan is discussed in Section 9.5 of the FSV ISFSI SAR, which is periodically updated in accordance with regulatory requirements.

APPENDIX G

DECOMMISSIONING PLAN SUPPLEMENT

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G1.0 EXECUTIVE SUMMARY

This proposed Decommissioning Plan, required by 10 CFR 72.30, was previously revised in accordance with NRC Regulatory Guide 3.65 which applied to final decommissioning plans (Reference G15-1). NRC Regulatory Guide 3.65 cites to and endorses the approach described in NUREG-1757 (Reference G15-2). Certain information contained herein relates to activities that are prospective in nature, and will be subject to revision based on knowledge gained over the course of facility operation. This plan is intended to provide assurance that the Fort St. Vrain (FSV) Independent Spent Fuel Storage Installation (ISFSI) will be safely and efficiently decommissioned by examining the recommended elements of NUREG-1757 that will make up the final Decommissioning Plan that will be submitted in accordance with 10 CFR 72.54 at a later date.

The guidance in NUREG-1757 suggests that the FSV ISFSI and associated decommissioning needs best fit that for a Decommissioning Group 3 licensed facility where licensed material is used in a way that could meet the screening criteria, but the license may eventually need to be amended to modify or add procedures to remediate buildings or sites. The format of this proposed Decommissioning Plan therefore follows that recommended for a Decommissioning Group 3 licensed facility.

The Department of Energy (DOE) is the owner and licensee of the FSV ISFSI. The Idaho Operations Office address for DOE is: Department of Energy, Idaho Operations Office, 1955 Fremont Avenue, Idaho Falls, ID 83415. The FSV ISFSI is a spent fuel dry storage facility located near Platteville, Colorado. The address of the ISFSI is: FSV ISFSI, 17122 Weld County Road 19 ½, Platteville, CO 80651.

The FSV ISFSI is located next to the former FSV Nuclear Generating Station site; about 3.5 miles northwest of the center of the town of Platteville in Weld County, Colorado, and about 35 miles north of Denver. The majority of the land within 30 miles of the site is agricultural characterized by irrigated farm land and pasture land with gently rolling hills. The grade elevation at the ISFSI is approximately 4,781 feet above sea level. The minimum distance from the MVDS outer concrete surfaces to the Controlled Area Boundary is approximately 331 feet (101 meters). The natural topography of the ISFSI facility site is generally flat, with slight slope to the northeast toward the Platte River 0.5 miles to the east. The area immediately surrounding the MVDS is surfaced with either asphalt or a gravel road base material and is maintained essentially vegetation free. The areas north and east of the ISFSI site continue to be used for farming.

DOE is authorized under License No. SNM-2504 to receive, possess, store, and transfer at the FSV ISFSI fuel elements from the FSV Nuclear Generating Station, as well as transuranium elements, source material, byproduct material, special nuclear material, and associated radioactive material related to the receipt, storage, and transfer of the fuel elements.

The FSV ISFSI has been maintained essentially free of any measureable loose surface radioactive contamination in all accessible areas. The exterior of the FSCs have not come into contact with radioactive materials, and should not become contaminated during continued storage operation and defueling.

After the FSCs are removed from the FSV ISFSI, the facility should require little or no remediation; therefore the decommissioning objective in this proposed Decommissioning Plan is unrestricted use. The final decision concerning which decommissioning alternative to implement will be made prior to submittal of the final Decommissioning Plan.

If radiological conditions at the FSV ISFSI prior to license termination are such that the decommissioning objective of unrestricted use cannot be achieved without decontamination (e.g. residual radioactivity distinguishable from background radiation that results in a Total Effective Dose Equivalent to an average member of the critical group greater than 25 mrem/y), then Derived Concentration Guideline Levels (DCGLs) for the ISFSI site, corresponding doses, and methods by which they are determined will be included in the final Decommissioning Plan. A summary of ALARA evaluations performed to support the decommissioning will be provided at that time. If a license termination under restricted conditions needs to be requested, then the restrictions to limit doses and a summary of institutional controls and financial arrangements for the ISFSI site will be provided in the final Decommissioning Plan. A summary of any public participation undertaken to comply with 10 CFR 20.1403(d) or 20.1404(a)(4), as appropriate, will also be provided at that time.

A more refined schedule and proposed post-remediation activities will be submitted with the final Decommissioning Plan during the extended license period and prior to any request for license termination.

If DOE does not request and receive an exemption from the decontamination and decommissioning provisions of the NRC regulations, a final Decommissioning Plan will be submitted prior to the termination of the NRC license, in accordance with the requirements of 10 CFR 72.54. At a minimum, the final plan will include a description of current condition of the FSV ISFSI, the choice of decommissioning alternative to be implemented, a description of controls and limits on procedures and equipment, a description of final survey, an updated cost estimate, and a description of technical specifications and quality assurance provisions.

G2.0 FACILITY OPERATING HISTORY

The Fort St. Vrain (FSV) Independent Spent Fuel Storage Installation (ISFSI) is a spent fuel dry storage facility located near Platteville, Colorado. The FSV ISFSI is operated by CH2M - WG Idaho, LLC (CWI) for the Department of Energy (DOE). The FSV ISFSI is licensed by the Nuclear Regulatory Commission (NRC) pursuant to 10 CFR 72 for authorization to store spent nuclear fuel from the Fort St. Vrain Nuclear Generating Station (Reference G15-4).

The FSV ISFSI Modular Vault Dry Store (MVDS) design is a dry storage system that effectively confines the spent fuel and potential contamination within the sealed Fuel Storage Containers (FSCs). Prior to decommissioning, the fuel storage containers are planned to be removed from the vault modules using the container handling machine and then deposited into a licensed shipping cask. Final disposal arrangements for the fuel elements are not yet known. For decommissioning of the ISFSI, DOE plans a 2-year ISFSI defueling period, and a 6-month dismantlement, decontamination, and decommissioning period.

G2.1 LICENSE NUMBER/STATUS/AUTHORIZED ACTIVITIES

DOE is authorized under License No. SNM-2504 to receive, possess, store, and transfer at the FSV ISFSI fuel elements from the FSV Nuclear Generating Station, as well as transuranium elements, source material, byproduct material, special nuclear material, and associated radioactive material related to the receipt, storage, and transfer of the fuel elements. Transuranium elements (thorium and uranium enriched to ≤93.15% U-235) are in the form of irradiated TRISO coated ThC_2 and UC_2 fuel particles inside graphite fuel elements. Other transuranium elements and the source material, byproduct material, and associated radioactive material is in the form of irradiated fuel elements, contaminated ISFSI equipment, depleted uranium shielding materials, and low-level radioactive waste. Byproduct and special nuclear material is also in the form of calibration discs or sealed sources used for sample analysis and equipment calibration.

Under the current license the maximum amount of radioactive material that DOE may possess at the FSV ISFSI is 1,036 Kg uranium and 14,540 Kg thorium initially contained in 1,482 irradiated HTGR fuel elements. The maximum amount of other transuranium elements and the source material, byproduct material, and associated radioactive material is limited to that quantity contained in 1,482 irradiated HTGR fuel elements, 270 contaminated fuel storage containers, one potentially contaminated container handling machine, three potentially contaminated storage wells, three depleted uranium shielding components of transfer casks, and low-level radioactive waste. The gamma and neutron source terms for the average fuel element are documented in the FSV

ISFSI SAR, Tables 7.2-1 and 7.2-2 (Reference G15-5). The storage locations of spent fuel and radionuclides at the FSV ISFSI are shown in the FSV ISFSI SAR, Figures 1.1-1, 1.1-2, and 1.1-3 (Reference G15-5).

G2.2 LICENSE HISTORY

The FSV ISFSI was originally licensed (License No. SNM-2504) by the NRC pursuant to 10 CFR Part 72 for authorization to store spent nuclear fuel from the Fort St. Vrain Nuclear Generating Station on November 4, 1991. Spent fuel from the FSV reactor was transferred to the FSV ISFSI between December 26, 1991 and June 10, 1992. Originally licensed to Public Service of Colorado (PSCo), the FSV ISFSI license was transferred from PSCo to the U.S. Department of Energy, Idaho Operations Office (DOE-ID) on June 4, 1999.

The radionuclides and maximum activities of radionuclides authorized and used under the original license have not changed. The chemical forms of the radionuclides authorized and used are as described in the original license. A scale drawing and map of the site, facilities and environs of the FSV ISFSI are shown in the FSV ISFSI SAR, Figures 2.1-1, 2.1-2, and 2.1-3 (Reference G15-5).

Based on the current fuel storage conditions, there are no areas of anticipated radioactive contamination at the FSV ISFSI. Since the exterior of the FSCs have not come into contact with radioactive materials, the FSCs should not become contaminated during continued storage operation and defueling. After the FSCs are removed from the FSV ISFSI, the facility should therefore require little or no remediation. Limiting the number of areas that will require remediation increases the likelihood that this plan can be implemented safely and economically.

G2.3 PREVIOUS DECOMMISSIONING ACTIVITIES

There has been no loose surface radioactive contamination detected-to-date at the FSV ISFSI and no previous decommissioning activities have been performed.

G2.4 SPILLS

There has been no history of spills or uncontrolled release of radioactive material from the FSV ISFSI.

G2.5 PRIOR ONSITE BURIALS

There has been no onsite burial of radioactive material at the FSV ISFSI.

G3.0 FACILITY DESCRIPTION

G3.1 SITE LOCATION AND DESCRIPTION

The FSV ISFSI is located next to the former FSV Nuclear Generating Station site. The site is located about 3.5 miles northwest of the center of the town of Platteville in Weld County, Colorado, about 35 miles north of Denver, and about 20 miles directly west of the Rocky Mountain Range. The elevation changes in all other directions north, east, and south of the site are typified by changes of only tens of feet within 30 miles surrounding the site.

The majority of the land within 30 miles of the site is agricultural. The area within a few miles of the site is characterized by irrigated farm land and pasture land with gently rolling hills. The grade elevation at the ISFSI is approximately 4,781 feet above sea level. The site is also located about 1 mile south of the confluence of the South Platte River and the St. Vrain Creek, 0.5 miles west of the South Platte River, and 0.75 miles east of the St. Vrain Creek. The FSV ISFSI general location, the plot plan of the FSV power generating plant and the ISFSI, and the ISFSI general arrangement are shown in the FSV ISFSI SAR, Figures 2.1-1, 2.1-2, and 2.1-3 (Reference G15-5). The local road network is described in the FSV ISFSI SAR, Section 2.2.3 (Reference G15-5).

The ISFSI administration building, as reviewed and licensed by the NRC in the original license application, contains office space for ISFSI operations. Six 230 kV transmission lines originating from the FSV switchyard are routed as shown in the FSV ISFSI SAR, Figure 2.1-5 (Reference G15-5). The nearest 230 kV transmission line route is about 1,500 feet west of the ISFSI facility. A 13 kV distribution line serves the ISFSI facility from the east.

The minimum distance from the MVDS outer concrete surfaces to the Controlled Area Boundary is approximately 331 feet (100 meters). The ISFSI site is bounded by an 8 feet high chain link fence with outriggers. The FSV ISFSI Security Program establishes and maintains physical security for the ISFSI facility. The natural topography of the ISFSI facility site is generally flat, with slight slope to the northeast toward the Platte River. The general surface drainage pattern is not altered by the addition of the ISFSI facility. The area immediately surrounding the MVDS is surfaced with either asphalt or a gravel road base material and is maintained essentially vegetation free. The ground surfaces surrounding the exterior of the MVDS structure and the access trailer are sloped away for drainage. Where potential for erosion exists, provisions are made to prevent such occurrence. Other than ISFSI operation, no other activity is conducted inside the ISFSI controlled area. The areas north and east of the ISFSI site continue to be used for farming. The area around the ISFSI site includes gas wells. These activities do not affect the operation of the ISFSI, and are not expected to significantly affect decommissioning activities.

G3.2 POPULATION DISTRIBUTION

The population distribution of permanent residents within five miles of the ISFSI location is displayed in the FSV ISFSI SAR, Figure 2.1-4 (Reference G15-5). The population is shown in each of the sixteen sectors at 1 mile increments. The nearest permanent residence is located approximately 0.5 miles north of the ISFSI facility. The population figures were computed based on the 2000 census. There is some seasonal fluctuation in the population in agricultural areas surrounding the site due to migrant farm workers. The usual length of stay for these workers is about four months during the summer. The number of migrant and seasonal farm workers in the Greeley area for two previous growing seasons averaged only about 500 persons. These farm workers, combined with all other visitors and transients within five miles of the ISFSI location during the summer, would probably amount to no more than a 20% increase over the number of permanent rural residents.

Changes will occur in population density and land use mainly in and around the cities and towns and along the major highways through this region. The higher growth rates will occur in the larger metropolitan areas. The FSV ISFSI SAR, Table 2.1-2 (Reference G15-5), shows projected population for major cities in the area. A list of the past population, 1980 population and projected population of the other smaller towns within a 5-mile radius is presented in the FSV ISFSI SAR, Table 2.1-2 (Reference G15-5). The future population trend is projected to the year 2041, through the license renewal period of the ISFSI facility. The population within the 5-mile radius of the ISFSI is projected to be 16,959, with 7,773 residing in Platteville. The estimated rural population will remain essentially the same through this period. The projected population distribution is shown in the FSV ISFSI SAR, Table 2.1-2 (Reference G15-5).

G3.3 CURRENT/FUTURE LAND USE

The FSV ISFSI SAR, Section 2.1.4 (Reference G15-5) describes the ISFSI site being located in the southwest corner of Weld County, Colorado, which is a large county with an area of 4,033 square miles. The climate is dry and generally mild with long, warm summers, open winters and a growing season of 138 days. The surface is level or rolling prairies with low hills near the western border and elevations ranging from 4,400 to 5,000 ft.

Based on 1984 studies, Weld County ranked first in the State in total crop value. The County also ranked second in bushels of barley produced, third in bushels of winter wheat harvested, second in bushels of corn for grain, first in production weight of dry beans, first in tons of sugar beets, ninth in bushels of oats, first in tons of hay, first in estimated number of cattle and calves on farms in the County, and first in number of cattle and calves on feed. Approximately 946,000 beef cows and heifers were inventoried in the County as of 1984.

In 1977 the leading industries in Weld County were livestock, food processing, and electronics. The largest employers were in education, trade, irrigated agriculture, services, livestock and electronics, in that order. By the year 2000, the major employers were projected to be in education, government, electronics, trade, livestock, and irrigated agriculture, in that order (Reference G15-5).

Weld County production of various minerals, petroleum, natural gas and coal constitute significant portions of the overall production within the State of Colorado. Coal mining is a major activity in the area beginning about 10 miles southwest of the ISFSI near the towns of Frederick and Firestone, and extending on the southwest.

In 2009 Swift and Company (beef processing), North Colorado Medical Center (health care), State of Colorado (government), and Weld County District 6 (public education) are the major employers in Weld County. Other industries in the County include canned food and food products, meat packing plants, prepared animal foods, fertilizers and farm equipment.

Land use within a 30-mile radius of the ISFSI location remains primarily agricultural. The major farm products include feed corn, sugar beets, vegetables, beef cattle, sheep and turkeys. There also is a limited amount of dairy farming in the area. The industrial facilities within a few miles of the ISFSI site are primarily located in the town of Platteville, about 3.5 miles southeast of the ISFSI.

The oil/gas wells and associated gas pipelines within approximately a 1-mile radius of the ISFSI are shown in the FSV ISFSI SAR, Figure 2.2-1 (Reference G15-5). Combustion turbines and heat recovery steam generators for the FSV repower project have been installed on the east side of the Turbine Building 1,400 feet south of the ISFSI. The repowering facilities are fueled by natural gas, and are further described in the FSV ISFSI SAR, Sections 2.2.1 and 3.3.6 (Reference G15-5).

Numerous permanent residences are dispersed within a 5-mile radius, with the only municipal population at the town of Platteville. The balance of the population is rural. There are seven residences located on Xcel (the successor company to PSCo, the original FSV Nuclear Generating Station and FSV ISFSI licensee) property, but none is within the exclusion area, the nearest being about 0.5 miles north of the ISFSI facility.

Since the majority of the land within a 5-mile radius is privately owned and zoned agricultural, no public recreation facilities exist in the area. The St. Vrain Creek and South Platte River, the major natural waterways in the area, are not large enough to be used for water transportation, boating or water skiing. These two waterways, via diversion ditches, supply the majority of the irrigation water for the farm lands.

G3.4 METEOROLOGY AND CLIMATOLOGY

The FSV ISFSI SAR, Section 2.3 (Reference G15-5) describes the general climate around the FSV ISFSI as being typical of the Colorado eastern-slope plains region. In this semi-arid region the precipitation averages 10 to 15 inches a year, mostly from thunderstorms in late spring and summer. The wind records show no dominant direction, although winds out of the north by northeast segment do occur with the greatest frequency. The winds are generally light (10 mph), with higher velocities occurring during various atmospheric disturbances. The weather is generally mild. Most seasons are characterized by low humidity and sunny days, with occasional, short-lived storms bringing precipitation into the area. Relative humidity averages about 40 percent during the day and 65 percent at night. Thermal radiation losses resulting from lack of cloud cover provide considerable variation in temperature from night to day. Although snowfall is significant, the snow cover is usually melted in a few days.

Actual on-site measurements at Fort St. Vrain for the period 1986 through 1989 yielded the following weather extremes: maximum temperature of 103.8 °F, minimum temperature of -26.3 °F, and a maximum wind velocity of 48 mph at Wind Direction 6.5 degrees NNE (Reference G15-5). Seasonally, winds tend to be strongest in the late winter and spring, the season with high chinook frequency, and again in the summer, when thunderstorms occur frequently. Strong winds, especially under chinook conditions, have been observed on various occasions in eastern Colorado. The chinook winds are strongest immediately to the east of the mountain ridge and diminish rapidly over the plains with increasing distance from the mountains. The measurement records at the ISFSI site reveal a strong prevalence of northerly and southerly winds caused by the shallow depression of the St. Vrain Creek and the South Platte River and by the proximity of the Rocky Mountains.

The FSV ISFSI is located in a region that typically experiences five tornadoes per year per 10,000 square miles with the peak tornado activity occurring in the month of June. Maximum wind velocities in severe tornadoes of the FSV region are typically less than their midwestern counterparts.

G3.5 GEOLOGY AND SEISMOLOGY

The geology and seismology of the region in which the FSV ISFSI is located is described in the FSV ISFSI SAR, Section 2.5 (Reference G15-5). The area contains the confluence of St. Vrain Creek with the South Platte River. The most striking topographic feature of the area is the abrupt northeast-southwest trending escarpment along the northwest side of St. Vrain Creek and the South Platte River. Over most of the area, the topography is characteristically the near flat, stepped topography formed by several terrace levels along the major drainage. The area lies mainly in the valley of the South Platte River. Rocks of Cretaceous and Quaternary ages have been identified in the area. No rocks of Tertiary age have been recognized in this vicinity. The valley of the South Platte was cut in rocks of Cretaceous age and has undergone repeated filling and cutting by streams during the Quaternary with the result that the modern valley of the South Platte is developed primarily of Quaternary alluvial deposits.

The surficial sediments and the present topography reflect primarily changes in the South Platte River and its tributaries during the late Quaternary. During the Tertiary period, sediments were deposited and then removed by streams which were probably ancestral to the modern South Platte River. The earliest stage of topographic development evident in this area is the sedimentation in the early Pleistocene which produced the Verdos Alluvium, suggesting that the South Platte may have been as much as 150 feet higher than at present. Subsequent to the development of the pediment beneath the Verdos, the streams began deepening their channels in the Cretaceous rocks. Aggradation in the channels of the major streams led to the deposition of the Older Quaternary Valley Deposits. Most probably these deposits represent not a single episode of deposition, but rather a relatively long period of repeated deposition and removal of material. The present topography and surficial deposits represent only the latter phases in the cutting-filling of the valley deposits. By late Wisconsin time, the Valley had been filled to approximately the level of the top of the terrace formed by the Broadway Alluvium, which represents the channel-flood plain deposits of the late-Wisconsin South Platte River. During recent time, the river cut through the Broadway Alluvium to develop a lower flood plain on which the Piney Creek Alluvium was deposited. Most recently, the river again lowered its channel to about the present level and the Post-Piney Creek Alluvium began to accumulate. The repeated history of post-Tertiary erosion and deposition in the valley of the South Platte River reflects climatic changes in the mountains to the west. Episodes of glaciation and deglaciation altered both the flow characteristics of the streams and the availability of sediment. The topography and Quaternary sediments of the valley suggest a Quaternary history of climatic changes rather than changes in the base level induced by uplift.

The structural geology of the area is relatively uncomplicated. The area lies within the Denver Basin and is relatively close to the axis of the basin. Cretaceous rocks are nearly flat-lying. In the northwest part of the area where Cretaceous rocks are exposed, the beds dip gently to the east. Maximum dip of the Cretaceous beds is 1.5 to 2 degrees. Outside the area to the east, the dip is to the west.

The subsoils at the ISFSI facility site are St. Vrain - Platte River alluvial sands and gravel overlying Pierre claystone/shale bedrock. Generally, there is up to 5 feet of loose, slightly clayey sand overlying 4 to 7 feet of loose and medium dense, clean to silty sand underlain in turn by medium dense to dense, silty and slightly silty sand and then very dense, gravelly sand overlying hard claystone/shale bedrock at 47 to 49 feet. The claystone/shale changed to very hard claystone/shale at 49 to 51 feet. The loose sands have moderate strength, but will consolidate considerably if subjected to high soil bearing pressures. If saturated loose sands are subjected to a Design Basis Earthquake (DBE), they are at risk of liquefaction. The medium dense and dense sands are stronger than the shallower sands and much less susceptible to consolidation even under higher soil bearing pressures. The deeper sands should not liquefy during a DBE because of their depth and higher density even though they are below the water table. The hard and very hard claystone/shale bedrock is an excellent foundation strata.

No evidence of recent faulting has been discovered in this area. The vast majority of Colorado earthquakes occur west of the continental divide and, like most earthquakes in the world, appear to be associated with late Tertiary and Quaternary volcanism. In the last one hundred years, only two Colorado earthquakes have had an observed maximum modified Mercalli intensity of VII. A Magnitude 5 earthquake on April 10, 1967 produced ground accelerations at St. Vrain Valley of 0.002 g plus or minus 0.001 g. Based on history, it is estimated that the facility will be subjected to horizontal accelerations no larger than 0.02 g during its lifetime. Competent bedrock (Pierre Shale) exists whose bulk and shear moduli are 1.4E+06 and 1.0E+05 psi respectively. No velocity contrast exists between the water saturated overburden and the bedrock, thus precluding refraction seismic mapping of the bedrock surface. No unforeseen factors appeared during the investigation that would adversely affect the choice of the site. No earthquakes have ever been observed in the vicinity of Platteville. The closest active area is in northeast Denver, about 25 miles south of the FSV ISFSI site. Based on history, the maximum intensity likely to be experienced by the ISFSI facility during its lifetime will be associated with an earthquake originating in the Denver area. Seismic occurrence data subsequent to 1967 shows that there have not been earthquakes of comparable magnitude. Based on the seismic history, it appears unlikely the ISFSI site will experience a significant earthquake ground motion during the life of the installation. The MVDS structure was conservatively designed to horizontal earthquake ground acceleration of 0.1 g and vertical earthquake ground acceleration of 0.07 g without loss of function. It is unlikely that this level of ground motion will be exceeded during an earthquake similar to any historical event.

The FSV site lies on the east flank of the Colorado Front Range which is a complexly faulted anticlinal arch and on which are superimposed numerous smaller folds and faults. The rocks of the core of the anticlinal arch are Precambrian crystallines, including gneisses, schists, and quartzites which have been intruded by granitic rocks that range in age from Precambrian to Tertiary. On the east flank of the arch are Paleozoic and Mesozoic sedimentary rocks.

The regional structure of this part of Colorado is characterized by sedimentary rocks dipping eastward into the Denver Basin. Along the mountain front the regional structural pattern is interrupted by relatively small, en echelon anticlines that plunge to the southeast. In addition to the fold axes, two groups of faults have been recognized. The most notable occurs along the mountain front and includes a series of faults extending in a generally northwest-southeast direction from the Precambrian into the

Paleozoic-Mesozoic sediments. The second group of faults has been recognized primarily in coal mines, located generally east of Boulder. These faults have a northeast-southwest orientation. Both groups of faults are relatively high angle faults. There are no known active faults at the ISFSI facility site. The faults and the minor folds are related to the uplift of the Front Range which began in Late Cretaceous and continued into the Tertiary.

Up to about 12 feet of natural sand materials at the MVDS structure was excavated and reused as structural backfill material. The sands were placed in 8-inch maximum loose lifts at 4 percent below to optimum moisture content and compacted to at least 98 percent of modified Proctor maximum dry density. The compacted backfill and the underlying natural soil are not susceptible to liquefaction during a DBE event. The MVDS structure's reinforced concrete mat foundation is designed to bear on soil with allowable soil bearing pressure of 3,000 psf. The estimated total settlement of the MVDS structure is on the order of 1 inch. The settlement due to dead load occurred during construction and that due to live load upon first application of the live load due to the granular nature of the soils.

The administration building is founded on continuous footings bearing on loose natural sand with maximum allowable soil bearing pressure of 2,000 psf. The estimated total settlement of the administration building is in the order of 1 inch and differential settlements between footings were estimated to be one-half of the total that occurs. The settlement due to dead load occurred during construction and that due to live load upon first application of the live load due to the granular nature of the soil. The loose sands underlying the administration building foundation are at risk to liquefaction if saturated and subjected to a DBE event. The administration building is not required to function subsequent to a DBE event; therefore improvement of the soil conditions to prevent liquefaction has not been necessary. Backfill around foundations are well compacted.

G3.6 SURFACE AND GROUND WATER HYDROLOGY

The ISFSI location is between the South Platte River and St. Vrain Creek about 2 miles south of the confluence of these two streams. Four ditches traverse portions of the Xcel owned FSV power generating facility property and the surface water rights are owned by them. No ditches cross the FSV ISFSI property owned by DOE. In addition, several shallow wells are located on the FSV power generating facility site. One monitoring well has been drilled on the FSV ISFSI site.

The flow of ground water on the site is toward the alluvial deposits of both the South Platte River and St. Vrain Creek, but predominately toward the South Platte River Valley. The presence of the ISFSI facility does not change the hydrology of the FSV site. No water is diverted from the South Platte River or St. Vrain Creek for use at the ISFSI. Surface runoff at the ISFSI due to precipitation is not noticeably altered as the runoff continues to flow toward the South Platte River Valley once outside the FSV ISFSI site, following the natural contour of the land.

Cooling water is not required for the operation of the ISFSI because the MVDS structure is designed to provide a passive self-regulating cooling system that induces buoyancy driven ambient air to flow across the exterior of the fuel storage containers. Domestic water for the administration building is supplied via a line tapped into the existing Weld County water distribution system. The total annual water usage is minimal with the majority used for sewage disposal and personal hygiene.

There is no effluent from the MVDS structure since there is no active source of water inside the MVDS. As a precaution, provisions have been made in the MVDS design to discharge any water that may accumulate inside the vaults. The floors of the vaults are sloped to cause any accumulated water to flow into a drainage trench which in turn discharges the water into a pipe that protrudes from the exterior of the MVDS. The pipe has a valve that is normally closed, and the end of the pipe is capped. Routine surveillances check for water buildup inside the pipe. The water is tested for radiological contamination prior to its disposal. The effluent from domestic water used at the administration building is discharged into the septic system.

G4.0 RADIOLOGICAL STATUS OF FACILITY

G4.1 CONTAMINATED STRUCTURES

With the exception of radioactive calibration sources confined to a locked source cabinet, and depleted uranium in steel clad shield plugs on the Charge Face, all radioactive material is confined to the Fuel Storage Containers (FSCs). Radiological surveys performed-to-date do not indicate the presence of residual radioactive material in excess of site background levels. It is anticipated that once the FSCs are removed from the FSV ISFSI the facility will not have been impacted by licensed operations.

G4.2 CONTAMINATED SYSTEMS AND EQUIPMENT

Radiological surveys performed-to-date do not indicate the presence radioactive material contamination outside the confines of the FSCs in systems or on equipment.

G4.3 SURFACE SOIL AND SUBSURFACE SOIL CONTAMINATION

Radiological environmental monitoring results generated-to-date and facility operating history do not indicate the presence of soil containing residual radioactive material in excess of site background levels.

G4.4 SURFACE AND GROUND WATER

There are no bodies of surface water at the FSV ISFSI. There have been no liquid effluent releases from the FSV ISFSI. The absence of surface water and liquid effluent releases provides reasonable assurance that there is no radioactive material contamination in water.

G5.0 PLANNED DECOMMISSIONING ACTIVITIES

NUREG-0586 (Reference G15-6) describes the following three decommissioning alternatives:

- DECON – equipment, structures, and other portions of a facility and site containing radioactive contaminants are removed or decontaminated to a level that permits the termination of the license shortly after cessation of facility operations.
- SAFSTOR – the facility is placed and maintained in a condition that allows it to be safely stored and subsequently decontaminated to levels that permit the termination of the license.
- ENTOMB – radioactive contaminants are encased in a structurally long-lived material, such as concrete. The entombed structure is appropriately maintained, and continued surveillance is carried out until the radioactivity decays to a level that permits the termination of the license.

The final decision concerning which alternative to implement will be included in the final Decommissioning Plan. The decision will be based on many factors, including, physical condition of equipment and structures over a long-term period, optimization of radiological aspects, environmental impacts of the project, existence of technical resources, availability of waste management and disposal facilities, costs, and public opinion.

This proposed Decommissioning Plan assumes DECON will be the preferred alternative. As such, the approach to decommissioning the FSV ISFSI will be to decontaminate equipment and building surfaces, demolish and completely remove the building, and free release as many items as possible for recycling/salvage. The design of the facility, the selected construction materials, and the aggressive preventive and protective methods used during the operating life will minimize the amount of actual decontamination required during decommissioning. A majority of building surfaces and some equipment should be released for unrestricted use.

Equipment and surface decontamination methods will be chosen to minimize secondary wastes and ensure the maximum amount of free-releasable items without unnecessarily inflating costs. By continuing to operate the FSV ISFSI relatively free of radiological contamination, the disposal of large amounts of radiologically contaminated materials at the end of plant life is avoided. This is important because wholesale disposal places an unnecessary burden on the nation's waste handling system and increases the potential for the public to be exposed to radiologically contaminated wastes.

Decommissioning of the FSV ISFSI is divided into two broad phases, decontamination and dismantling. The decontamination phase will begin after all spent nuclear fuel has been transferred from the FSV ISFSI. Major activities that will occur during this phase include removing contaminated systems and components, and decontaminating structures. The dismantling phase will include removal of contaminated structures, systems, and components as well as removal of temporary systems, components, and structures required to contain and control radioactive materials during decommissioning activities (such as tents, waste generated during decontamination activities, and the like) when no longer required. These temporary systems will then be decontaminated (as necessary) and removed for the performance of the final site survey. Site restoration activities not involving radioactive materials will eventually be performed under DOE regulations and may be conducted prior to or following the termination of the NRC license.

Decontamination and dismantling phase activities for FSV ISFSI decommissioning will involve the reduction of radioactivity to acceptable levels, allowing the termination of the NRC license. For the FSV ISFSI, these activities should be limited because of the way the facility has been designed and operated. The FSV ISFSI is designed such that no significant amount of contamination is expected, either during initial loading or during normal operations over the life of the facility. The following are examples of facility design features which reduce the possibility of contaminating FSV ISFSI components.

- Fuel storage containers were loaded, sealed and leak tested in the FSV Reactor Building prior to transfer to the ISFSI. This reduces or eliminates possible contamination at the ISFSI since off-normal activities are not anticipated in the MVDS.

- Fuel storage containers are designed to be corrosion resistant therefore there should be little or no presence of loose contaminated corrosion products.

- There are no active cooling or safety systems associated with the MVDS therefore there are no means to entrain and transport contamination within the MVDS.

- Contamination may occur in the event of a failed fuel storage container. If this were to occur, contamination would be primarily restricted to the container handling machine and the loading point where the fuel would be removed from the defective fuel storage container and placed in a new fuel storage container.

- Design of major components allows easy decontamination (e.g., the charge face structure is painted).

- The fuel particles have a TRISO ceramic coating (primary fission product barrier) to reduce or eliminate the possibility of fission product release.

In order to terminate the 10 CFR 72 license, DOE will decontaminate to an established level for residual radioactivity which will allow release for unrestricted use. DOE will then make a decision as to whether further dismantlement activities will be pursued.

G5.1 CONTAMINATED STRUCTURES, SYSTEMS AND EQUIPMENT

The remediation tasks for any radiologically contaminated structures, systems and equipment will be included in the final Decommissioning Plan. Resources for performing such tasks will be allocated accordingly from both licensee and contractor staff. The remediation techniques employed will be described in the finial Decommissioning Plan, and will include decontamination and removal or dispositioning in accordance with the INL Waste Management Program. The radiation protection methods and control procedures employed during the remediation will also be summarized in a later update of this Decommissioning Plan. There are currently neither procedures already authorized nor procedures for which approval is being requested for implementation of the remediation tasks. Such procedures will be developed during the decontamination planning phase to ensure that decommissioning activities are conducted in accordance with written and approved procedures. There are currently no unique safety or remediation issues associated with remediating the FSV ISFSI.

G5.2 SOIL

The removal/remediation tasks for any radiologically contaminated surface and subsurface soil will be included in the final Decommissioning Plan. Resources for performing such tasks will be allocated accordingly from both licensee and contractor staff. The removal/remediation techniques employed will be described in the final Decommissioning Plan. The radiation protection methods and control procedures employed during soil removal/remediation will also be summarized in the final Decommissioning Plan. There are currently neither procedures already authorized nor procedures for which approval is being requested for implementation of the soil removal/remediation tasks. Such procedures will be developed with the final Decommissioning Plan to ensure that decommissioning activities are conducted in accordance with written and approved procedures. There are currently no unique safety or removal/remediation issues associated with remediating the soil at the FSV ISFSI.

G5.3 SURFACE AND GROUND WATER

The remediation tasks for any radiologically contaminated ground and surface water will be included in the final Decommissioning Plan. Resources for performing such tasks will be allocated accordingly from both licensee and contractor staff. The remediation techniques employed will be described in the final Decommissioning Plan. The radiation protection methods and control procedures employed during the remediation will also be summarized in the final Decommissioning Plan. There are currently neither procedures already authorized nor procedures for which approval is being requested for implementation of the remediation tasks. Such procedures will be developed with the final Decommissioning Plan to ensure that decommissioning activities are conducted in accordance with written and approved procedures. There are currently no unique safety or remediation issues associated with remediating ground or surface water at the FSV ISFSI.

G5.4 SCHEDULES

The total time period to accomplish dismantlement, decontamination and decommissioning is estimated to be approximately 2.5 years. This estimate assumes use of the existing Model TN-FSV (Certificate of Compliance Number 9253) Cask (or equivalent). A schedule for completing the dismantlement, decontamination and decommissioning activities will be supplied during a later update of the Decommissioning Plan to ensure the amount and duration of time planned to complete such activities can be verified for reasonableness.

G6.0 PROJECT MANAGEMENT AND ORGANIZATION

G6.1 DECOMMISSIONING MANAGEMENT ORGANIZATION

At the time the final Decommissioning Plan is prepared, information will be provided concerning the structure and functions of the decommissioning project management organization. This information will include a description of the decommissioning organization, a description of each of the decommissioning project units within the project including responsibilities, a description of the reporting hierarchy within the decommissioning project management organization, and a description of the responsibility and authority of each unit to ensure that decommissioning activities are conducted in a safe manner and in accordance with approved written procedures.

G6.2 DECOMMISSIONING TASK MANAGEMENT

At the time the final Decommissioning Plan is prepared, information will be provided concerning the manner in which the decommissioning tasks are managed, how the manner for managing such tasks is developed, reviewed and approved by the decommissioning project management organization how such tasks are evaluated, how the manner for managing such tasks is managed throughout the decommissioning project, and how individuals performing such tasks are kept informed of the procedures used to implement such tasks.

G6.3 DECOMMISSIONING MANAGEMENT POSITIONS AND QUALIFICATIONS

Experienced and knowledgeable contractor personnel will perform the technical and administrative tasks required during decommissioning. To the extent practicable, the decommissioning team will include personnel previously employed at the FSV ISFSI to capitalize on their familiarity with the facility. However, a separate contractor to provide specialized services and/or expertise may be used for decommissioning from the contractor that operated the facility.

At the time the final Decommissioning Plan is prepared, information will be provided that describes the duties and responsibilities of each management, ES&H, engineering, quality assurance and waste management position in the decommissioning organization, the reporting responsibility of each position, the minimum qualification for each position, and a description of all decommissioning and safety committees. Information will also be provided that describes the health physics and radiation safety education and experience required for individuals acting as the facility/project Radiation Safety Officer (RSO), as well as the responsibilities and duties of the RSO, and the specific authority of the RSO to implement and manage the radiation protection program.

G6.4 TRAINING

The FSV ISFSI training program is designed to provide instruction to ensure that personnel have the knowledge and skills necessary to perform their job functions safely. Training applicable to specific activities, tasks, and conditions will be developed or discontinued as decommissioning progresses. The training program will be maintained throughout decommissioning as necessary to provide the FSV ISFSI personnel with the specialized training and technical skills necessary to maintain the facility in a safe condition.

Persons requiring access to the FSV ISFSI will receive general training, which will include an introduction to the FSV ISFSI, the fundamentals of radiological protection, techniques to maintain radiation exposure ALARA, the emergency response plan, facility safety, fire protection, physical protection, and quality assurance. The content of the course may be revised as needed during decommissioning.

Task-specific training for selected activities will include the appropriate level of training in decontamination, decommissioning activities, and radiation protection. Managers will ensure that employees and contractors who perform decommissioning activities are properly trained, qualified, and proficient in the principles and techniques of activities necessary to perform their assigned tasks, in accordance with approved procedures. Records of training will be maintained in accordance with the FSV ISFSI records management program.

The background, qualifications, and experience of instructors will be appropriate for the subject matter. Instructor qualifications will be administratively controlled by approved procedures.

G6.5 CONTRACTOR SUPPORT

Tasks for which contractors may be used to provide support during decommissioning may include, but are not limited to, processing, packaging, transportation, and disposal of radioactive material; decontamination and recycling of radioactively contaminated material; radiation protection; fire protection; design and fabrication of special dismantling equipment; engineering and design services, such as heavy loads management and transportation engineering; and dismantlement and demolition of components, systems, and structures.

During decommissioning planning the responsibility for contractor control, including the contractor’s effectiveness in performing to bid specifications, will either be DOE directly or will be otherwise identified. The responsible entity will provide management oversight to ensure that tasks performed by the contractors are in full compliance with the Quality Assurance Plan for the FSV ISFSI, the purchase agreement, and applicable regulatory requirements.

Potential contractors for decommissioning activities will be required to supply their qualifications as part of bid specifications. These qualifications will be evaluated and reviewed for safety record, safety program, demonstrated experience in providing services on similar projects, cost and schedule compliance, technical and operational capability, ability to meet regulatory requirements, financial reliability, and evaluation of key personnel qualifications.

G7.0 RADIATION SAFETY AND HEALTH PROGRAM DURING DECOMMISSIONING

Radiation protection and ALARA policies are followed in activities and decisions related to radiation protection and radiological controls. The policies and requirements of the radiation protection program are described in the Radiation Protection Plan. The ALARA measures incorporated into the design of the facility to ensure the safety of the personnel during operation will also provide a measure of protection during the decommissioning phase. Complete training of the decommissioning personnel as well as thorough planning for each decommissioning activity will also contribute to achieving compliance with ALARA principles.

G7.1 RADIATION SAFETY CONTROLS AND MONITORING OF WORKERS

The FSV ISFSI implements and maintains a radiation protection program commensurate with the scope and extent of its licensed activities in accordance with 10 CFR 20.1101. The radiation protection program includes a workplace air sampling program, a respiratory protection program, internal and external exposure determination guidance, summation of internal and external exposure guidance, a contamination control program, and an instrument program to demonstrate compliance with applicable requirements of 10 CFR 20.

G7.2 NUCLEAR CRITICALITY SAFETY

Nuclear criticality will not be a radiological hazard during decommissioning since all fissionable material will be removed from the ISFSI before decommissioning activities commence.

G7.3 HEALTH PHYSICS AUDITS, INSPECTIONS, RECORDKEEPING PROGRAM

The radiation protection program includes annual program review and recordkeeping requirements demonstrating compliance with 10 CFR 20.1101 and 2102.

G8.0 ENVIRONMENTAL MONITORING AND CONTROL PROGRAM

The FSV ISFSI is designed such that operation of the facility will not result in a significant dose commitment greater than 0.15 mrem/y to the nearest resident. A constraint on air emissions of radioactive material to the environment is not established since by design no significant radioactive emissions are generated during routine fuel storage operations. FSV ISFSI Technical Speciation 5.5.4 describes how the effluent control, environmental monitoring, and reporting requirements of 10 CFR 72.44(d) are implemented. Technical Speciation 5.5.4 will continue to be implemented during the decommissioning.

G9.0 RADIOACTIVE WASTE MANAGEMENT PROGRAM

The radiation protection program includes a radioactive waste management program to demonstrate compliance with 10 CFR 20.2001 through 20.2006. Although there is currently no solid or liquid radioactive waste or mixed waste generated at the ISFSI, provisions exist for dispositioning such waste as appropriate in accordance with the INL Waste Management Program described in the FSV ISFSI SAR, Chapter 6 (Reference G15-5) pursuant to DOE responsibilities under the Atomic Energy Act of 1954, as amended.

G10.0 QUALITY ASSURANCE PROGRAM OVERVIEW

The FSV ISFSI Quality Assurance Program, described in the FSV ISFSI SAR, Chapter 11 (Reference G15-5), addresses the organization, quality assurance program, document control, control of measuring and test equipment, corrective action, quality assurance records, and audits and surveillances.

G11.0 RESTRICTED USE AND ALTERNATE CRITERIA

DOE-ID does not intend to request termination of the ISFSI license using the restricted use or alternate criteria provisions of 10 CFR 20, Subpart E (Reference G15-7).

G12.0 MODIFICATIONS TO DECOMMISSIONING PROGRAM AND PROCEDURES

A later update of this Decommissioning Plan will include a detailed description of how the decommissioning program will be reviewed and re-evaluated as conditions at the ISFSI change, and, as appropriate, modify procedures to meet the reduced risk.

G13.0 FACILITY RADIATION SURVEY

A final facility radiation survey will be performed to determine the condition of the FSV ISFSI site after decontamination activities have been completed. The purpose of the survey will be to demonstrate that radiological conditions at the site meet license termination criteria. A detailed plan for the survey will be submitted to the NRC for approval prior to the final survey and the submittal of the application for license termination. Guidance for developing the final radiation survey plan will be obtained from applicable NRC guidance, including NUREG-1575 and NUREG-1757 (References G15-3 and G15-2). The final survey results will be provided to the NRC to support license termination. The final survey will be designed so that the NRC can verify procedures, results, and interpretations.

Final release criteria for contamination, exposure, and concentration levels will be designed to ensure that radioactivity at the site is reduced to levels that allow termination of the license. Release of the site, facility, and materials will be based on release criteria for surface contamination, direct exposure, and soil and water concentrations consistent with applicable provisions of 10 CFR 20, Subpart E (Reference G15-7).

G14.0 FINANCIAL ASSURANCE

DOE is responsible for requesting, through the budget process, the necessary funds to decommission the FSV ISFSI. The costs (in 2008 dollars) for the selected decommissioning alternative have been estimated at approximately $2.4 million for radiological decommissioning activities. The cost estimate is based on Regulatory Guide 1.86, "Termination of Operating Licenses for Nuclear Reactors," dated June 1974 (Reference G15-8). DOE believes that utilization of this guidance provides a conservative basis for the planning and cost estimate for eventual decommissioning of the ISFSI. DOE will request the necessary funding from Congress for the decommissioning of the ISFSI at the proper time. Table 1 provides a cost estimate breakdown for decommissioning the ISFSI. This estimate is based on several assumptions. Decommissioning and dismantlement activities are expected to begin with equipment teardown assumed to have negligible cost. The MVDS structure and equipment will require minimal decommissioning or dismantling. Decontamination labor resources will work 40 hours/week for 26 weeks. Costs include a 25% contingency or management reserve.

Table G14-1. FSV ISFSI Decommissioning Cost Estimate (2008 dollars)

Cost Category	Cost Subcategory	Cost
Equipment	Cleaning Tools	$699,661
	Vacuum Systems	
	Filtration Systems	
	Temporary Enclosures	
	Cutting Equipment	
	Conventional Tools	
Labor (Decontamination)	Health Physicist (1)	$555,613
	Engineer (1)	
	Laborers (4)	
Radioactive Waste Disposal		$194,558
Miscellaneous Expenses	Final Release Survey	$970,919
	Site and Building Characterization	
	License Termination Costs	
Total		$2,420,751

G15.0 REFERENCES

G15-1 U.S. Nuclear Regulatory Commission (2008), Regulatory Guide 3.65, *Standard Format and Content Decommissioning Plans for Materials Licensees*, Revision 1, Washington, D.C.

G15-2 U.S. Nuclear Regulatory Commission (2006), NUREG-1757, *Consolidated Decommissioning Guidance: Decommissioning Process for Materials Licensees*, Revision 2, Washington, D.C.

G15-3 U.S. Nuclear Regulatory Commission (2000), NUREG-1575, *Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)*, Revision 1, Washington, D.C.

G15-4 Title 10, Code of Federal Regulations, Part 72, *Licensing Requirements for the Independent Storage of Spent Nuclear Fuel and High-Level Radioactive Waste*, Washington, D.C.

G15-5 FSV ISFSI Safety Analysis Report, current revision

G15-6 U.S. Nuclear Regulatory Commission (1988), NUREG-0586, *Final Generic Environmental Impact Statement on Decommissioning Nuclear Facilities*, Washington, D.C.

G15-7 Title 10, Code of Federal Regulations, Part 20, *Standards for Protection Against Radiation,* Washington, D.C.

G15-8 U.S. Nuclear Regulatory Commission (1974), Regulatory Guide 1.86, *Termination of Operating Licenses for Nuclear Reactors*, Washington, D.C.